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In referring, March 8, p. 292, to the crude utterances of the New York State Railroad Commission concerning block signaling, we were guilty of a crudity ourselves, for which we beg the reader's pardon. In condemning permissive blocking as unsafe, we referred, of course, to that which actually has proved unsafe, namely, that of freight trains on long block sections under manual signaling; but the careless omission of qualifying words made the condemnation apply to all permissive movements, as, for example, the movement of a passenger train past an automatic block signal which stands in the "stop" position because of the breakage of a wire or a battery jar. An esteemed correspondent, writing to point out the error, asks if we should expect to operate automatic block signals in any other way than by permissive rules. Certainly not. At this point the question naturally arises, Why has permissive blocking resulted in more collisions under the telegraph block system than under the automatic? We have no statistical information that it has; but such is the impression from the accident records. So far as this is a fact, the reason appears to be that with block sections two or three miles long, and longer, enginemen take more risks than where the sections are only one mile long or less. Just what this indicates concerning the relative efficiency of the discipline under the two kinds of blocking, we are not prepared to say; possibly runners who are not disciplined at all would do better with short block sections; but it ought to be easier to maintain good discipline with short than with long blocks. It is true that collisions have occurred under permissive blocking, on lines equipped with automatic signals and divided into short blocks; and it may be that the New York State Commissioners know of so many such cases that they really desire to enforce something like absolute blocking everywhere. If this is the case, the only practical test of the reasonableness of their demand is that to be found in the results. What is the best record that can be shown? The object of block signaling is the entire prevention of collisions. Absolute blocking will do this. With automatic signals absolute blocking would mean waits of 10 or 15 minutes when signals are out of order, and, perhaps, flagging ahead, or a telephone connection from every signal to the nearest station. This would be expensive and troublesome. But if, some day, a train running under a permissive indication collides with the train ahead of it and thereby kills a dozen passengers (passing in an express train on an adjacent track) what can that railroad say to the Commission? Public opinion would support the state in demanding controlled manual (absolute) signaling on such a line at once. Like a two cent fare law, which proves profitable by increasing the volume of passenger traffic, this demand might not prove an unmixed evil. The way to stave it off, however, is to make permissive blocking so safe that nobody can complain. One way to "jack up" the discipline under automatic blocking, where jacking up is needed, would be to enforce for a time a five-minute wait at every signal remaining in the stop position.

THE LEGISLATIVE PASS.

There's a kind of divinity, a species of fascinating halo, that doth hedge about the railroad free pass. He who is undeserving and yet gets it, feels stamped deep on his mental and moral sensorium that satisfying human concept of getting something for nothing. He who deserves it contemplates the pass as a symbol and token of personal virtue blended with the practical utilities of free transit. Even the railroad official, entitled to his pass by law, by propriety, even by necessity, and wonted to it by custom, probably never quite outgrows the pass as a signet of his official dignity, and there is just a little extra chest inflation as the conductor, cognizant and respectful, passes him by without demand for the potential pasteboard. This dignity of the pass, partly natural, partly artificial, even reaches from the vulgate into the language of euphemism. Do not railroad companies, not a few, substitute for the harsh but expressive "free pass" such gentler infinitives as "to supply transportation"? But the free pass under the new interstate commerce law has had a sudden area of atmospheric and moral depression and has passed from the realm of dignity to the limbo of criticism and restriction. And, in that transition period it brings to light no attitude of human nature more diverting than that of some of the state legislatures beset by the cry of the corporation baiters on the one hand and the charms of the free pass on the other.

Not to mention some amusing instances of this dilemma in western states one comes to an illuminating case in New Hampshire. There, it will be recalled, in the dominant Republican party there was last summer and autumn a red-hot campaign waged against legislative free passes with the novelist, Winston Churchill, and his new "Lincoln party" in the van of conflict. Mr. Churchill lost the nomination for Governor by a small margin, but he and his followers hewed out a drastic anti-pass plank and got it nailed in the party platform. It called for a penal statute restricting the free pass to railroad, express and mail officers and employees and "persons in misfortune who are unable to pay their fares." The legislature has now been in session for some weeks wrestling with the railroad pass question, confronting a condition as well as a pre-election pledge and harassed by survivals of the Puritan conscience battling with the seductions of the adversary marked in the free pass. The sub-climax is amusing as a study in the humanities and legislative ethics. Recently, by a vote of 221 to 100, the New Hampshire lower house voted to substitute free railroad tickets for free passes. Satan thus came out uppermost, throned on a compulsory law in which the "big stick" was tied to railroad obligation. The lower house of the New Hampshire legislature contains 413 members, and is by far the largest state legislative body in the Union. Students of legislative ethics and responsibility will find here an object lesson in the moral values of big legislative bodies "fresh from the people," and, in contrast to state senates,

so large—in theory—as to be impervious to corporate temptation.

In its wider horizons the theme opens itself to more sober thoughts. The interstate commerce law does not bear on intrastate passes and thus touches but remotely on the question of legislative freedom on the rail. It may be said also that—unless honor be deemed a makeweight—legislators in many states are sadly underpaid, provided, of course, that they hold down their seats punctually at legislative sessions, do their full work on committees and scorn "perquisites" in both large and small significations. Casuists may also try to stretch the free pass statute for the state railroad commissions, who administer the law, to the men who make the law; but their logic and analogy are indifferent at best. There is sounder reasoning for the policy of states which commute legislative mileage for a session pass paid for by the state treasury. Meanwhile, as the various American commonwealths are slowly toiling through the free pass equation, the philosophic mind must be permitted to dwell on its very human phenomena; on the legislative temper which makes the pass criminal in several states and leaves it full swing in another; on the fundamental charm of the free pass as aforesaid; and on the Miltonian struggle of Good and Bad, of Duty versus Pocket, when a legislator hotfoot from a constituency clamorous for railroad "reform" fronts the grim actualities of paying his own fare. It all contributes to that mirth of man which goes so far to soften the hardest of life's problems.

THE DANGERS OF MUNICIPAL OWNERSHIP.

Mr. Robert P. Porter's study of the workings of municipal ownership, based on conditions existing in England within his own observation and supplemented by references to the instructive experiences of the colonies and foreign cities as well, comes as a very timely contribution to a subject that ought to be understood a great deal better than it is. England has passed through a sharp attack of the municipal ownership fever. We say it has passed through rather than it is passing through, because the County Council election a few weeks ago, from which the returns are now at hand, resulted in a sharp defeat for the Progressives, who had the full support of the Liberal party, and advocated municipal trading in extension. Apart from municipal water supply, which is generally conceded to be a proper function of the municipality, municipal trading in England did not become an issue until after 1882, and has been an issue of first class importance only within the last fifteen years. During that time it has flourished amazingly, and received its first real setback in the London County Council election just reported.

The first and most helpful point to be kept in mind in reviewing this subject throughout its complexities, is that municipal trading, in extension, embracing not only the control of water works, but of lighting, street railways, and especially of housing, is a form of socialism. The London *Times*, in 1902, recognized that the aims of the municipality and of the socialists were identical, and boldly christened the whole movement as "municipal socialism, pure and simple," bringing forth angry protests from the municipality, but making a designation none the less correct.

The strength which the movement has acquired in England may doubtless be attributed in large measure to the universal desire to have one's burdens borne by someone else. Mr. Porter points out that in England and in America alike, the people who control elections are not the people who pay taxes, as a characteristic. The Midland Railway pays one-eighth of all the taxes of Derby; one shipbuilding company pays one-sixth of all the taxes at Jarrow; there is also a colliery company which pays almost all the taxes of one township, while colliers who do not pay a cent can vote down the one or two officials in the colliery and the few farmers and shopkeepers in the neighborhood. Corporate bodies, such as railroad companies, and, in fact, all limited liability concerns, whose contributions to local taxation form an enormous sum, do not possess a municipal vote and are, therefore, denied any voice in the disposition of the money they pay to their local authority. It is an easy matter, therefore, for a municipal ownership party to gather around it the vote of the non-responsible, and put into effect all sorts of improvements designed to compete with the efforts of private capital, holding forth, on the one hand, promises (almost never realized) of lower prices or better service, and, on the other hand, of employment for all, with the highest pay and the shortest hours.

The general truths embodied in such a presentment of the situation have been known for some time, but it has remained for Mr. Porter to show clearly and strikingly some easily remembered ways in which municipalities show profits from their ventures where no actual profits exist, and thus create the illusion that their improvement works actually tend to decrease taxes instead of swelling taxes beyond all bounds, as has actually been the case. At the foundation of the so-called profit from municipal trading lies a bad balance sheet. A private company, operating a street railway, for example, has no place to hide inconvenient expenditure. It must just go on the balance sheet, and if it has first created a deficit in the income account, that deficit must be set off against whatever profit has been carried forward. But the municipality labors under no such necessity. Mr. Porter cites the case of Liverpool, where the local debt at the end of 1905 had been increased by over $5,000,000 for street widenings made on account of the municipal tramways, but when it was proposed to charge the tramway undertaking with a portion of the expense, the motion was defeated. Another municipality, which boasted of large street railway profits, had charged $1,500,000 to the public works committee for street widening, necessitated entirely by the installation of street railways. The London County Council, however, has, as usual, been the leading light in this as in most other forms of municipal extravagance and bad accounts. It seems that a recent report which the Council was compelled to make, shows that $20,224,220 has been spent on street improvement, necessitated by tramway extensions, of which only $1,886,300 was debited to the tramway undertaking, the people of London being saddled with the rest. Moreover, it was shown that since the Council has entered into the tramway business, the cost of the central office has amounted in all to about $6,000,000, towards which has been charged on the tramway accounts only $40,800. As the author well says, the profits of such undertakings may be likened to the profits of a child from the egg industry, when his parents supply him with the chickens and the corn with which to feed them.

After this first device of not debiting to the expense side of the account all outlays made, the second common fallacy in municipal accounting is the failure to provide sufficient sums for depreciation, renewal of plant and sinking fund. Mr. Porter shows that the average yearly amount set aside for depreciation of reproductive municipal undertakings during the four years ended March 31, 1902, was less than one-sixth of 1 per cent. of the capital invested, while quite a large number of undertakings were not debited with any depreciation at all. As a result, the communities which have gone most heavily into municipal trading now find themselves equipped with out-of-date and inferior apparatus which they have no power to replace except through a fresh burden of taxes on the community.

The most striking demonstration of illusive profits, however, is that relating to municipal houses. This is a branch of municipal trading which has been undertaken quite widely in England, with the avowed object of supplying workingmen with proper and sanitary houses at a price within their means. But in the first place, the municipality is a bad buyer, and is regularly imposed upon by speculators who hold land ahead of it; in the second place it has almost always happened that the rents in the new municipal houses have been placed materially higher than those in the rookeries which they displaced, with the result that they accommodate a better class of people, for whom no such provision was necessary, while they drive the original tenants to seek other slums. The municipalities, to gain support for their undertakings, are fain to show a profit from the operation of these houses, but as the land they have to buy is so high priced that actual ground rents would place the houses quite out of the workingmen's reach, they are wont to write down the price at which the undertaking is carried on their books. Mr. Porter cites a parcel of land bought by the London County Council at Clerkenwell at a cost of $1,000,000, the value of which, for housing purposes, was written down to $225,000. The difference between these figures, $775,000, represents the loss in this particular case, which had to be borne by the taxpayers, although they were shown a profit on the Council's books.

It is well known that Australasia, especially New Zealand, has been widely advertised as the happy hunting ground of municipal traders. Mr. Porter shows how this has been accomplished. In 1905, the debit of the Australian commonwealth was $1,151,172,385, the debt of Australasia was $1,450,732,385, and the debt of the United States, $989,866,772. This works out to $11.91 per capita in the United States, to $288.60 in Australia and to $309.66 in the whole of Australasia, while in New Zealand the debt per capita was $348.10. Mr. Porter quotes the *Sydney Bulletin* to the effect that there were one or two gorgeous years in West Australia when the amount borrowed, if it had been divided equally among the people, would have enabled everybody to live in a humble but

honest fashion without doing any work at all. As a result, prosperity in Australasia is now chained down under this dead load of debt which has been accumulated; capital and industry are frightened away, and the good old days of indiscriminate borrowing are over, because credit is no longer equal to the strain placed upon it.

To sum the matter up in a brief sentence, Mr. Porter can see no good in municipal trading beyond the brief limits of water supply, and he presents an array of facts and figures that may well occasion the American cities around the southern tier of the Great Lakes, now coquetting with this subject, to stop and reflect where they are and whither they are tending.

WHAT IS STOCK WATERING?

Never before in the annals of American railroads has the phrase "stock watering" been heard so frequently as during the year past and at the present time. Legislators and commissions have voiced it; orators on the party stump have cried it; the newspapers and magazines have scored it with anathema; and very real over-capitalization of street railway corporations and "industrial" combinations have thrown it into bold relief. The Harriman inquiry is one of the recent official researches which have given the subject added prominence. It is becoming very evident that, in the future determination of the relation of the public to transportation interests, the question of capitalization is to fill a great space. From the viewpoint of both theory and practice, of academic searches on the one hand and of railroad capitalist on the other, the query, "what is real stock watering?" rises to terms of high import.

It seems at the first flush very easy to answer the query. Watered capital, one would say at the outset, is simply capital not paid in as cash—a denominational capital in a certain number of dollars raised to a sum exceeding the dollars actually contributed to an enterprise. Assuming no economic wastage in construction and in financing a project the same idea can be carried back a step further and reduced to the law of replacement value. Thus modified, stock watering would signify capitalization—of course not only in share capital but in debt also—exceeding the cost of replacing the property were it to be swept away. These definitions are primary and alphabetical and the ones most generally accepted. They evidently exclude franchise value, which introduces a disturbing factor to be referred to later. It may be said right here, however, that the foregoing definitions, nominally fundamental, have the fault of focussing attention over much on the face of the capitalization rather than on the equity or inequity of the return which that capitalization exacts from the public. Another way of stating the theorem is that too much stress has been laid on the investment rather than on its charges. The two, in fact, should be considered together and almost as synonymous terms just as in an ordinary note of hand, reckoned as an investment, we blend principal and interest.

In that broader and deeper sense the two conventional tests of stock watering, namely, cash paid in and replacement value, undergo some radical changes. Of two railroad projects, in both of which capital has been honestly paid in, one may have been successful from the start, the other waiting years for its dividend—intelligent operation and development in both cases being the same. Here is clearly a divergence in moral obligation to the public. "Cash paid in" in the one case has had its return; in the other case it has had no return. In the one case—from the public viewpoint—a gratuitous stock dividend would signify stock watering; in the other, under conditions of belated prosperity, it would signify merely a just return on vested cash to which return the public can raise no valid objection. This principle reaches out far. It includes the old value of railroad properties snuffed out by reorganization—at least so far as the original investors have shared in the reorganized enterprise as distinguished from later investors. The relative investment rights of the two groups and how to harmonize them with the rights of the public to lower rates is one of the obscure elements of the problem. The economist may, if he has the time, follow out this branch of the question to still more remote and nebulous ethics, as, for example, the railroads built by municipal aid and since reorganized with private profit.

Pushing this idea of valid return on cash paid in there opens up yet another circle of questions solid at its center but cloudy at its edges. One is the corporate right of capitalizing improvements, especially if those improvements—as they almost always do—pertain to public necessity and convenience. A railroad corporation may spend during ten years as many millions demonstrably separate from both ordinary operation and ordinary improvements. Yet new capitalization to that amount is almost sure to be charged up as stock watering and—in the case of a road paying good dividends—so classed even if the new stock is paid for at par. But if the same company increases its dividend and maintains it permanently no charge of "watering" is raised against it though, in public aspects, the situation may be exactly the same as though it "watered" capital and maintained the old dividend rate. The Delaware, Lackawanna & Western "stands pat" on stock and double dividend up to 20 per cent. while the shares rise to five fold par value. Yet who charges the company with watering stock! *Per contra* the Great Northern, regarded as a railroad, has for years stood pat on dividend rate while much expanding stock and is bitterly attacked for over-capitalization. Illustrating further the subject of valid capital may be taken some of the original telephone companies many of them at first, no doubt, over-capitalized. But costly replacements compelled either by new inventions, popular demand or both, have often squeezed out original water and forced a capital expenditure exceeding first capitalization; and, in the case of the telephone, unlike the railroads, there was the early perils of capital entering upon a new and untried invention subject to the risks of rival inventions that might prove better.

There are other elements that enter into this recondite question as to what constitutes the unwatered capital that renders at the same time equitable return to the investor and equitable rates as well as due convenience to the public. For example, shall or shall not the public service corporation be credited in new capitalization with the enhancement of the value of its franchise by a "going" concern? Where also shall the line be drawn in the division of the increment of railroad prosperity which assuredly belongs neither to the railroad corporation nor the public exclusively? Such misty queries must not, obviously, be used to befog stock watering actual, direct and speculative and which the merest tyro in finance can detect. But they do show that, in a vast number of cases where stock watering is charged, what may be called "solidifying" components must be considered; that no two instances are alike, and that each instance calls for its own analysis; and that in the general proposition we have no inflexible rules or absolute data. What we know is that in the present effort to detect and, if possible, penalize stock watering there is much confusion of vested rights, public rights and fiscal values, ratios and equities; and that penalty itself prompts the problem of the transfer of the watered security from the culpable promoter to the innocent buyer. But if that penalty has to pause in its correction of the past there is no reason why it should do so in the preventions of the future.

Train Accidents in February.[1]

Our record of train accidents occurring on the railroads of the United States in February includes 26 collisions, 20 derailments and three boiler explosions, 49 accidents in all. This record is not published in full, as was formerly done, except in the cases of the few accidents which are especially prominent—in the present instance five collisions and five derailments. The record of "ordinary" accidents—which term includes, for our present purpose, only those which result in fatal injury to a passenger or an employee or which are of special interest to operating officers—will henceforth be given as below, in the shape of one-line items for each accident, showing date, location, class and number of deaths and injuries.

This record is based on accounts published in local daily newspapers, except in the cases of accidents of such magnitude that it seems proper to send a letter of inquiry to the railroad manager. The official accident record published quarterly by the Interstate Commerce Commission is regularly reprinted in the *Railroad Gazette.*

The 10 prominent accidents in February are distinguished in

[1]Abbreviations used in Accident List:

rc.....Rear collision.
bc.....Butting collision.
xc.....Other collisions; as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars or a collision due to a train breaking in two on a descending grade.
b.....Broken.
d.....Defective.
dr.....Defect of roadway.
eq.....Defect in car or engine.
n.....Negligence.
unf.....Unforeseen obstruction.
unx.....Unexplained.
derail....Open derailing switch (negligence of engineman or signalman).
ms.....Misplaced switch.
acc. obst...Accidental obstruction.
malice....Malicious obstruction of track or misplacement of switch.
boiler.....Explosion of boiler of locomotive on road.
fire.....Cars burned while running.
Pass.....Passenger train.
Ft.....Freight train (includes empty, engines, work trains, etc.
*Wreck wholly or partly destroyed by fire.
†One or more passengers killed.

the list by printing the name of the road in italics. Following are condensed accounts of the circumstances of these 10 accidents. The three most prominent are Williamsbridge, Mineral Point and Saylor, all derailments.

The derailment at Williamsbridge on the 16th occurred about 7 p.m. It caused the death or fatal injury of 24 passengers and the injury of about 141 other persons. The train, a northbound passenger train of two electric locomotives and five passenger cars, was running at full speed over a 3 deg. curve. Four cars were dragged on their sides a considerable distance. This accident was reported in the *Railroad Gazette* of February 22, page 230, and March 8, page 292. The conclusion of General Manager A. H. Smith was that some foreign substance derailed the trailing wheels of the leading locomotive. Nothing more definite than this has yet been discovered as to the cause.

The derailment at Mineral Point, Pa., on the 22d, occurred in the night, and, like that at Williamsbridge, was due to some accidental obstruction, the nature of which has not yet been discovered. This accident was reported in the *Railroad Gazette* of March 1, page 272. On the editorial page of the same issue there are some interesting comparisons between this and the New York Central derailment.

The derailment at Saylor, Iowa, on the 4th, about 5.30 p.m., was due to the failure of one of the trucks of a gondola car loaded with coal, an arch bar breaking. This car and all in the train behind it, four cars of coal and a caboose, were knocked off the track and fell down a bank. The persons killed were miners riding on the cars of the freight train; and of the injured seven were miners, two were employees and two were young women being carried in the caboose by the courtesy of the conductor. It appears that the miners usually ride home from their work on a passenger train which, on the day in question, was behind time. Some 20 or 30 of these men boarded the freight train in spite of the protest of the conductor and brakemen. Thus while the victims appear to have been trespassers the public is likely to look upon the record as an addition to the list of casualties to passengers.

The butting collision near Colby, Ky., on the 5th between two freight trains wrecked both engines and the boiler of one of them exploded, killing one engineman and two trainmen; three other trainmen were injured.

The collision near Pelham, Ga., on the 7th, was due to the failure of a coupling between the passenger car and the freight cars of a mixed train of the Flint River & North Eastern, running on the Atlantic Coast Line track. The train was moving at moderate speed on a descending grade, and the forward portion when stopped was run into at the rear by the passenger car. Seven passengers and three employees were injured, but only three of them seriously. The train consisted of engine, two freight cars and one passenger car. Air-brakes were in operation on the engine and freight cars, but the trainmen had neglected to connect the air to the passenger car.

The collision at Ossining, N. Y., on the evening of the 8th was due to a slight miscalculation by the engineman of a heavy northbound freight train. This train, which was running on a middle siding, ran a few feet beyond the fouling point, at the outgoing end of the siding, just as a northbound passenger train came along, and the passenger engine was pushed over into the ditch and its engineman and fireman killed. The road at this point is block signaled and interlocked, but it would appear that there is no derailing switch at the outgoing end of the siding. This accident is one of a number of cases which have occurred recently wherein the men in charge of the train have been arrested and held on criminal charges, without much regard to the practical question whether they were or were not presumably guilty of criminal negligence. The men arrested at Ossining were the conductor, the engineman, the fireman and a helper on the freight train. As the freight train was running at low speed it is difficult to see how the conductor should bear any responsibility in the case, unless he was riding in the locomotive; and the engineman, himself—however grave may be his fault technically or morally—cannot, in any appreciable degree, be guilty of that gross negligence which is contemplated in most laws which class offenses of this kind as criminal.

The collision near Ypsilanti, Mich., on the 21st, was between a train of five express and mail cars, carrying no passengers, and an ice train which was switching on the main track. The express train ran into the engine of the ice train at full speed and six men were killed, two of them being postal clerks. The express train had a clear (automatic) block signal and was properly within the block. A brakeman of the ice train had failed to see that the indicator was at danger before he turned the switch, and the ice train engine pulled out from the siding to the main track in the face of the express train. The coroner who investigated this case sustained the reputation of his "profession" for rare wisdom by declaring that the accident happened because the employees were "required to place too much reliance on the automatic block signals." We have been trying to figure out what this means. Probably the coroner's idea is that, as a brakeman may forget to note that the automatic system forbids him to turn a switch, there should be some other and non-automatic means to hold him to a more careful performance of his duty. Before doing anything to carry out this idea the coroner should post himself as to the attitude of other public authorities who criticise railroad practice in regard to the safety of trains. These, he will find, are nearly or quite unanimous in demanding automaticity in everything. They would depend on machines more, not less. Next we shall know, an automatic locomotive will be demanded, which, with complete automatic stopping apparatus, will give enginemen a chance to ride in the parlor car. Seriously, it looks as though a time release should be applied to those switches which are so far from the entrance to the block section as to allow heedless men to so freely indulge their heedlessness.

The collision near Leith, Nev., on the 28th, was between a part of a work train and some standing cars, the train being bound for a washout, and near to it. Two freight cars filled with workmen were pushed violently against other cars, heavily loaded, and a large number of men were crushed under a car body. Eight or more of these men, badly hurt, had to be carried 430 miles to have limbs amputated.

The derailment at German Valley, Ill., on the 7th, occurred about 2 o'clock in the morning, and was caused by a heavy passenger train of six cars running into a side track at full speed, about 50 miles an hour. The engine ran into and partially demolished a grain elevator, and the wreck was immediately buried, nearly out of sight, by a large quantity of grain falling down from the elevator upon it. The baggage cars and first passenger car were badly damaged. The engineman and two postal clerks were instantly killed. An order had been issued notifying all trains to run slow at German Valley, as the main track was obstructed, and trains were temporarily being run over the side track. The fireman of the train, who was not dangerously injured, said after the accident that the engineman had done a number of reckless things on that trip and that he made an impertinent reply when the fireman reminded him of the slow order. It is believed that the engineman had become mentally unbalanced. The switch light showed red, and this should have caused the engineman to stop if he had been attending to his duty.

The derailment near Indian Creek, Pa., on the 28th occurred at about 7 p.m., and all the five cars of the train, passenger train No. 49, westbound, fell down a bank. The cars immediately took fire probably from the firebox, and were completely burned. The engineman was caught under the engine and burned to death; the fireman and two other trainmen and six passengers were injured. It is believed that the train was derailed by a rock which had fallen from the hillside.

Train Accidents in the United States—February, 1907.

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Killd.	No. persons reported Inj'd.
1.	Chic., Rk Isld & Gulf	Hicks.	bc.	P. & Ft.	0	7
2.	Baltimore & Ohio	Pittsburg.	rc.	Ft. & Ft.	2	2
5.	*Chesapeake & Ohio*	Colby.	bc.	Ft. & Ft.	3	3
†6.	Mo., Kan. & Texas	Alvarado.	rc.	Ft. & Ft.	2	2
7.	Bessemer & Lake Erie	Mercer.	bc.	Ft. & Ft.	1	3
*7.	Pennsylvania Lines	Mingo Junctn.	xc.	Ft.	0	15
7.	*Flint River & N. E.*	Pelham, Ga.	xc.	Pass.	0	10
8.	*New York Central*	Ossining.	xc.	P. & Ft.	2	6
8.	Chic., Mil. & St. P.	Chicago.	xc.	P. & Ft.	1	12
8.	Chic., L. S. & Eastn.	Chicago.	bc.	Ft. & Ft.	1	3
10.	Norfolk & Western	Clark.	bc.	Ft. & Ft.	1	4
11.	M., Jackson & K. C.	Lucedale.	xc.	Ft. & Ft.	1	0
12.	Southern.	Johnston.	rc.	Ft. & Ft.	2	3
13.	Mo., Kan. & Texas	Wade.	bc.	Ft. & Ft.	1	4
14.	Chicago Gt. West'n	Pearl City.	rc.	Ft. & Ft.	1	1
15.	Char. & W. Car.	Jackson.	xc.	P. & Ft.	0	4
15.	Missouri Pacific	Jefferson City.	bc.	P. & Ft.	0	10
18.	Yazoo & M. V.	Alligator Lake.	bc.	P. & Ft.	1	13
20.	Chic., Cin. & Louisvl.	Kitchell.	rc.	Ft. & Ft.	1	1
21.	Chic., Mil. & St. P.	Beaver Dam Jc.	bc.	P. & Ft.	0	3
21.	*Michigan Central*	Ypsilanti.	xc.	Ft. & Ft.	6	1
22.	Chicago Gt. Westn.	Sargent.	rc.	P. & Ft.	0	15
26.	Trinity & Brazos V.	Limestone.	bc.	Ft. & Ft.	0	5
27.	Wabash	Mexico, Mo.	bc.	P. & Ft.	1	20
28.	Chic., Burl. & Quincy.	Chariton.	xc.	Ft. & Ft.	2	1
28.	*San Pedro, L.A. & S.L.*	Leith.	xc.	Ft.	3	40

Derailments.

Date.	Road.	Place.	Kind of train.	Cause of derail't.	No. persons reported Killd.	No. persons reported Inj'd.
2.	Louisvle & Nashvle.	Bracktown.	Ft.	unx.	1	2
4.	Northern Pacific.	Grafton.	Ft.	snow.	0	3
4.	*Chic. & North-Westn.*	Saylor, Ia.	Ft.	b. truck.	8	11
5.	Wisconsin Central	Oshkosh.	Pass.	unx.	0	2
†7.	*Chic. Great Westn.*	German Val'y.	Pass.	n.	3	3
8.	Gulf & Ship Island.	Bond.	Ft.	unx.	1	1
8.	Lehigh Valley	W. Danby.	Pass.	unx.	0	7
8.	Chic., Burl. & Quincy.	Peoria.	Pass.	d. switch.	1	2
9.	St. L. & San Fr'isco.	Pratt City.	Pass.	b. rail.	2	7
13.	Williams Valley	Brookside, Pa.	Pass.	b. rail.	0	20
13.	N. Y., Ont. & Westn.	Luzon.	Pass.	boiler.	3	15
14.	Iowa Central	Geneva.	Pass.	b. truck.	0	2
16.	Mo., Kan. & Texas.	Brookshire.	Ft.	b. flange.	1	0
†16.	*New York Central.*	W'msbridge.	Pass.	unx.	24	141
18.	Southern.	Littleton.	Pass.	d. switch.	0	2
22.	Chic., Mil. & St. P.	Wash'n Mills.	Pass.	b. flange.	2	12
†22.	*Pennsylvania*	Mineral Point.	Pass.	unx.	0	54
*25.	G. S. & Florida	Unadilla.	Pass.	d. switch.	1	3
*27.	N. Y., N. H. & Hart.	Bellingham.	Pass.	unx.	0	1
*28.	*Baltimore & Ohio*	Indian Creek.	Pass.	unx.	2	9

Other Accidents.

10.	Boston & Albany	Chester.	Ft.	boiler.	0	3
19.	Galveston, H. & S. A.	Strang.	Ft.	boiler.	1	1
28.	————	Englewood, Ill.	Ft.	boiler.	2	1

United States Steel Corporation.

Both gross and net earnings of the United States Steel Corporation reached new high records in the year ended December 31, 1906. The largest previous gross earnings were those of 1905, which were last year surpassed by 19 per cent. The net earnings increased 18 per cent, as compared with those of 1902, the largest net earnings heretofore recorded. The average prices received for steel products for domestic consumption were 5.3 per cent. higher than in 1905 and 8 per cent. lower than in 1902. It has been decided to make no change in prices at present, in spite of the increased cost of production. At the end of the year the company had unfilled orders booked for 8,489,718 tons of fabricated steel and iron, as compared with 7,605,086 tons at the end of 1905. Since January 1, 1907, orders have fallen off somewhat from the demand in the months immediately preceding, but are larger than in the corresponding months of 1906. The export shipments last year amounted to 1,079,319 tons, an increase of 13 per cent.; the gross receipts from this business increased 28 per cent.

The following table shows the iron ore mined and the output of the company's products during the last two years:

	Tons. 1906.	1905.
Iron ore mined:		
From Marquette Range	1,442,290	1,359,722
" Menominee Range	1,874,680	1,871,979
" Gogebic Range	1,465,375	1,671,747
" Vermilion Range	1,794,186	1,578,626
" Mesaba Range	14,068,617	12,004,482
Total	20,645,148	18,486,556
Coke manufactured	13,295,075	12,242,909
Coal mined*	1,912,144	2,204,950
Limestone quarried	2,227,436	1,967,355
Blast furnace products:		
Pig iron	11,058,526	9,940,799
Spiegel	150,044	158,071
Ferro-Manganese and Silicon	58,807	73,278
Total	11,267,377	10,172,148
Steel ingot production:		
Bessemer ingots	8,072,655	7,379,188
Open-hearth ingots	5,438,494	4,616,051
Total	13,511,149	11,995,239
Rolled and other finished products for sale:		
Steel rails	1,982,042	1,727,055
Blooms, billets, slabs, sheet and tin plate bars	1,096,727	1,253,682
Plates	836,399	780,717
Heavy structural shapes	620,823	484,048
Merchant steel, skelp, hoops, hands and cotton ties	1,240,548	982,782
Tubing and pipe	1,025,913	911,346
Rods	111,488	84,049
Wire and products of wire	1,399,717	1,283,943
Sheets—black, galvanized and tin plate	1,112,542	924,439
Finished structural work	643,622	404,732
Angle and splice bars and joints	176,730	150,265
Spikes, bolts and rivets	70,233	61,496
Axles	181,913	149,596
Sundry iron and steel products	79,736	28,236
Total	10,578,433	9,226,386
Spelter	28,884	29,781
Copperas (sulphate of iron)	21,933	20,040
Universal Portland cement, bbls.	2,076,000	1,735,343

*Not including that used in making coke.

Since the company was organized on April 1, 1901, $208,231,000 has been spent for additional property, construction and the payment of capital liabilities. Of this amount, $139,094,000 was for additional property and construction. These expenditures have been met as follows: sinking, depreciation and improvement funds, $52,527,000; issues of securities, $38,586,000; appropriated from surplus, $117,118,000. The increased earning power resulting from these outlays is indicated in the following table:

In production of products for further conversion.	Percentage of increase in capacity Jan. 1, 1907, with Apr. 1, 1901. Due to purchase of other companies.	Due to addit'ns and improvements made.	Total, increase.
Pig iron and blast furnace products	16.50	46.62	63.12
Bessemer and open-hearth stl ingots	13.35	43.29	56.64
Blooms, billets and slabs	17.08	44.69	61.77
Sheet and tin plate bars	7.90	81.15	89.05
Wire rods	20.95	Dec. 7.77	13.18
Products for sale.			
Finished steel and iron products	14.32	30.01	44.33
Universal Portland cement	.....	406.67	406.67

The lease of the Great Northern ore lands will be taken over by the Great Western Mining Company, a subsidiary of the steel corporation. Concerning the new plant at Gary, Ind., the report says:

There have been organized the Indiana Steel Company, which will construct the steel plant, and the Gary Land Company, which will own and improve the site for the city and will construct a large number of dwellings and business buildings. It is proposed to sell improved and unimproved property in the city to residents at about cost plus a fair interest charge, but under such restrictions as to the uses to be made of the property as may be found to be fair and reasonable. During the year substantial progress was made in the construction work, both on the steel plant and the city; the expenditures, including payments made for real estate, amounted to $4,720,158.91. There has been acquired for use for plant purposes, for the city of Gary, and for railroad yards and terminals, about 7,500 acres of property, with a large frontage on the shore of Lake Michigan. The appropriations approved to this date for construction work at the steel plant comprehend eight blast furnaces, together with the unloading and handling machinery, 56 open hearth furnaces, blooming and rail mill, various finishing mills, central power plant, foundries, machine shop and equipment, central pumping station and other accessory works; also the construction of harbor and docks. For the city of Gary the appropriations cover 331 dwelling houses, school and hotel buildings, waterworks, sewerage system, gas works, paving, sidewalks, grading, etc. The estimated amount yet to be expended on account of the foregoing approved work, and including payments to be made in 1907 for balance cost of real estate, is $40,000,000. On December 31, 1906, there was reserved in special fund available for account of these expenditures a balance of $26,867,797.89.

The income account for 1906 and for the preceding year follows:

	1906.	1905.
Gross earnings	$696,756,926	$585,331,736
Operating expenses	539,991,634	458,583,806
Net earnings	156,765,292	126,747,930
Other income	9,159,864	6,057,134
Net income	98,128,587	68,585,492
Dividends	*35,385,727	†25,219,677
Appropriation for Gary plant	21,500,000	10,000,000
Other appropriations	28,500,000	16,300,000
Surplus for the year	12,742,860	17,065,815

*7 per cent. on preferred and 2 per cent. on common.
†7 per cent. on preferred.

The Lackawanna, charged with illegal rebating on sugar, gets off by the disagreement of the jury, and probably the prosecution will not be renewed. There appears to be an important difference between the Lackawanna's transactions and those for which the New York Central and the Sugar company were fined in the aggregate $312,000 (*Railroad Gazette*, Oct. 26 and December 14, 1906); and the Government not only lacked a statute defining the Lackawanna's offense but was also prosecuting for the wrong kind of offense. But the Lackawanna's rebates were against public policy as clearly as were those of the New York Central. Like the heavy payments made several years ago by the transcontinental railroads to the Pacific Mail Steamship Company, to avoid a rate war, they were essentially violations of the pooling law, though perhaps not technically contrary to the terms of the law. Pooling cannot be carried on with the approval of the public except under government supervision and full publicity. The Lackawanna evidently paid Mr. Palmer for doing nothing at all; which is interpreted usually in the only way that it can rationally be interpreted, namely, as paying for immunity from a rate war. Between such payments and pooling there is no important difference.

Pennsylvania Railroad.

The calendar and fiscal year 1906, the sixtieth in the history of the company, was in several different ways an unusually important one for the Pennsylvania. Fundamentally, it was a year of unprecedented traffic and earnings. Financially, the annual dividend was increased from 6 to 7 per cent., and there were tremendous issues of new capital obligations, though only a small increase in stock outstanding. More important still, a large part of the stocks of the other principal bituminous coal roads reaching the Atlantic seaboard acquired in 1900 and 1901 were sold. From the standpoint of the management of the system, the death of Mr. Cassatt and the succession of Mr. McCrea as President, were of large importance, because this marked not a distinct change in the policy of the company, but rather the drawing to a close of an era in its development.

It must be remembered in considering the results achieved by the Pennsylvania Railroad that these returns do not include the operations of a very large part of the Pennsylvania system. East of Pittsburg the operations of the Philadelphia, Baltimore & Washington; Northern Central; West Jersey & Seashore; Cumberland Valley; New York, Philadelphia & Norfolk; Baltimore, Chesapeake & Atlantic; Maryland, Delaware & Virginia and Long Island railroads, with over 2,000 miles of line, are not included, nor are any of the more than 5,000 miles of line west of Pittsburg. The figures which are considered in this review are those for the 3,750 miles of line operated directly by the Pennsylvania Railroad Company. This is in four grand divisions, the Pennsylvania Railroad division, the United Railroads of New Jersey division, the Philadelphia & Erie Railroad division and the Buffalo & Alleghany Valley division.

The gross earnings of these lines (3,897 miles, including trackage rights) in 1906 were $148,200,000, an increase of $14,300,000, or 10 per cent. over 1905. Operating expenses increased 9 per cent., leaving net earnings of over $46,400,000, a gain of $5,900,000, or 14 per cent. over the previous year. These earnings are at the rate of $37,661 gross and $11,915 net per mile, but these large figures by no means represent the normal financial strength of the Pennsylvania

Railroad, for other income, which comes principally as return from investments, contributed $12,780,000, or $3,280 net per mile last year to the gross income of the company. Net income after fixed charges and other payments, was $35,670,000, an increase of $5,570,000 over 1905. From this $19,870,000 was paid in dividends, $4,200,000 as principal of car trusts, $8,700,000 spent and $2,500,000 reserved for extraordinary expenditures. No part of net income was transferred to profit and loss account for the year. Nor was the $15,200,000 profit from the sales of stock, which was all applied to betterments and improvements—$13,000,000 toward construction of the New York Tunnel Line and $2,200,000 transferred to the extraordinary expenditure fund. The amount to credit of profit and loss on December 31, 1906, was, therefore, the same as a year ago, $24,725,000. It is interesting to observe that the total amount spent and reserved out of income for betterment and improvement expenditures, including principal of car trusts, was over $30,600,000.

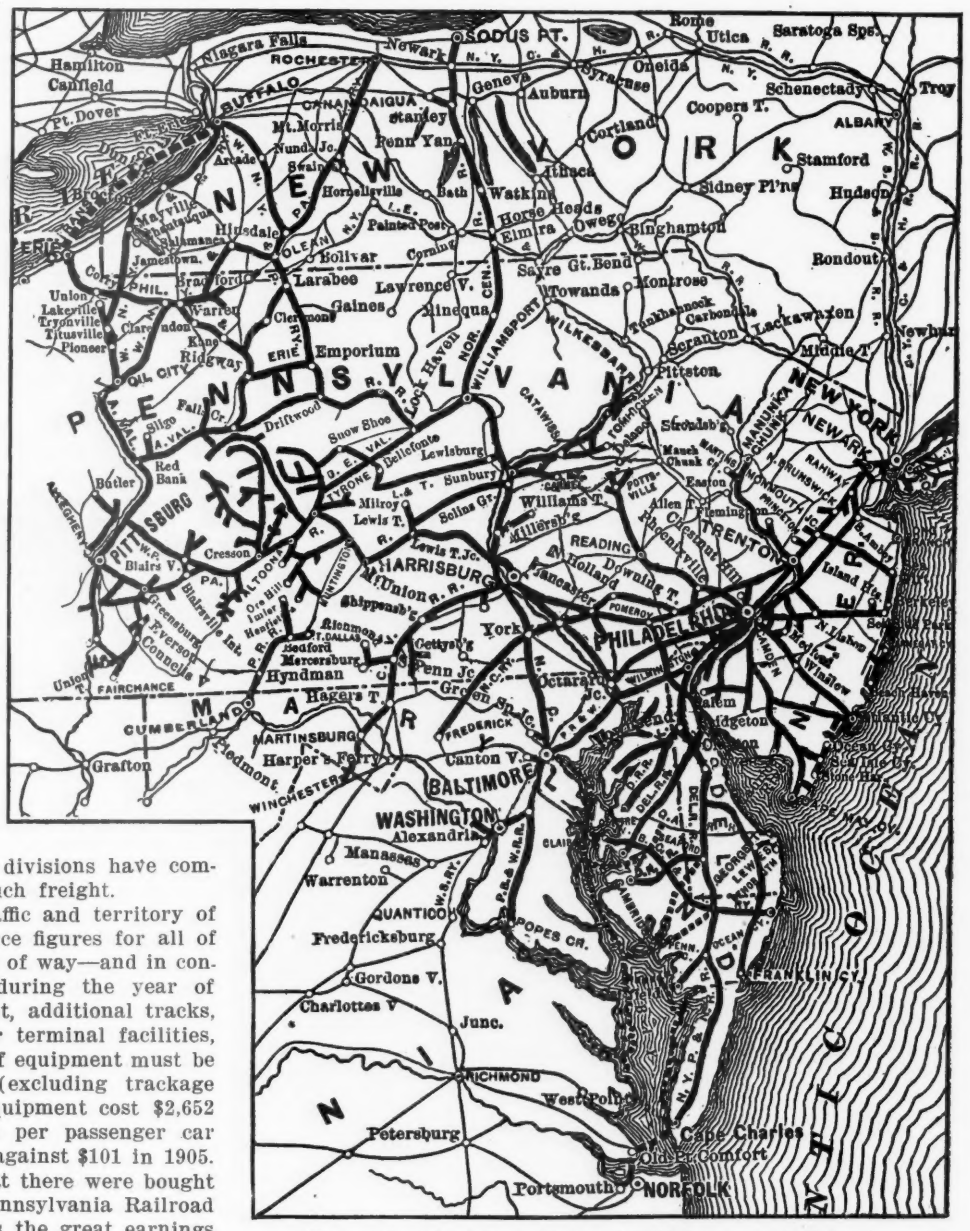
This income account of the Pennsylvania's is as remarkable a showing of railroad prosperity and large provision for the future as can be found. It should go far to reassure those who feel that the company has committed itself to plans too expensive for it to safely carry out. The territory served by the road is such that nothing short of a complete prostration of the primary industries, coal, iron and steel, could dangerously impair the earning powers of the road. By the time the Pennsylvania passes its dividend a large number of the rest of the railroads of the country will be in bankruptcy.

The traffic of the road is so large that it is difficult even to get an intelligent view of the operations of the less than 4,000 miles directly operated. In order to thoroughly understand the operations of the whole, the traffic and operating statistics of each grand division would have to be examined separately as can be done from the report. It is, however, possible to get a fairly accurate idea of the operations represented by the total figures for the lines directly operated by recalling that the Pennsylvania Railroad division runs from Philadelphia to Pittsburg, carries on its main line the heaviest traffic of any similar stretch of road in the country, both in tonnage and density, and by its branches reaches a tremendous area of bituminous coal workings. The United Railroads of New Jersey division includes the lines from Philadelphia to New York, Camden to South Amboy and branches, carrying the heavy traffic, particularly passenger traffic, of the New York division. The Philadelphia & Erie Railroad division runs from Sunbury, Pa., 50 miles north of Harrisburg, to Erie, on the Lake, with branches, and the Buffalo & Alleghany Valley division from Pittsburg to Buffalo and Rochester, with branches. The last two divisions have comparatively light passenger traffic, but carry much freight.

Taking into consideration the different traffic and territory of these four grand divisions the unit maintenance figures for all of them together are strikingly high. Maintenance of way—and in considering this figure the actual expenditure during the year of $8,700,000 for revision of grades and alinement, additional tracks, shops, yards, bridges, piers, stations and other terminal facilities, abolition of grade crossings and improvement of equipment must be remembered—cost $4,547 per mile operated (excluding trackage rights), against $4,091 in 1905. Repairs of equipment cost $2,652 per locomotive against $2,935 in 1905, $1,114 per passenger car against $945 in 1905, and $103 per freight car against $101 in 1905. In this connection also it must be observed that there were bought through car trusts during the year for the Pennsylvania Railroad Company alone, 23,803 cars. Fully as much as the great earnings these maintenance figures give proof of the wonderful business of the Pennsylvania.

Since the year 1899, 6 per cent. yearly has been paid on Pennsylvania stock. The increase in the rate last fall to 7 per cent. was like the increase in the New York Central rate from 5 to 6 per cent., in that it depended both upon increased earnings and larger dividend payments on stock of controlled companies. The Vandalia Railroad, the Pittsburg, Cincinnati, Chicago & St. Louis and the Pennsylvania Company increased their dividend payments during the year. The stock of the two former is held by the latter, and the Pennsylvania Company stock, by the Pennsylvania Railroad.

The new issues of securities during the year were made mostly through the Pennsylvania Company, whose credit was, for the time being, more available than that of the parent corporation with its large capital issues already outstanding. On May 1, 1906, that company issued $50,000,000 4½ per cent. 18-months' collateral notes, guaranteed by the Pennsylvania Railroad, to whose credit the proceeds were placed. The Pennsylvania Company also issued on June 15, 1906, and sold in France 250,000,000 francs, or about $48,000,000, of 3¾ per cent. 15-year trust obligations, the proceeds being used for securing a permanent water supply on the Lines East and for additional equipment. Besides this the Pennsylvania Company on April 2 issued $20,000,000 15-20 year 4 per cent. bonds for the needs of the Lines West, particularly the Northwest system. The capital requirements of the Pennsylvania Railroad for the current year are being met through the issue of $60,000,000 3-year 5 per cent. collateral notes put out since the close of 1906. Furthermore, in order that the directors may be free to make a new capital issue promptly when they deem the time available, the shareholders gave authority at the annual meeting this month to issue in future additional stock or bonds to the amount of $100,000,000. This brings up the total stock authorized to $500,000,000. These are large figures, all of them, so large that they have caused considerable anxiety in the minds of many as to the future of the Pennsylvania's finances. Yet they represent, not extravagant experiments, but rather simply a living up to marvelous opportunities.



Pennsylvania Lines East of Pittsburg and Erie.

The Baltimore & Ohio, Norfolk & Western and the Chesapeake & Ohio stocks were acquired to promote a more conservative policy in their management and to do away with discrimination between shippers. As these results have been largely obtained and maintenance of tariff rates appears secured by the present Rate Law and as, further, the securities could be sold at a large profit, all the Chesapeake & Ohio stock and a majority of the Baltimore & Ohio and Norfolk & Western holdings were disposed of. The disposition of the Baltimore & Ohio stock has been made public. It went to the Union Pacific and marks the first large entrance of the Harriman influence on the Atlantic seaboard.

The events of Mr. Cassatt's administration are briefly reviewed in the minute adopted by the directors after his death. The building of a complete new double track line from the summit of the Alleghanies to tidewater at New York, the new station and approaches at Washington and the Pennsylvania tunnel into New

York and under the East river, as well as to a connection with the Long Island, and the great new passenger station, all well under way or nearing completion, are mentioned as the most striking constructive achievements of his administration. The New York terminal, with its North and East river tunnels, has proved a more expensive project than he anticipated, but there is little doubt that it will, in the end, amply repay its great cost. The fact that the Pennsylvania is able to build it is only another way of saying that the business of the road demands it.

The following table shows the principal results of operation:

	1906.	1905.
Mileage worked	3,897	3,839
Freight earnings	$109,960,888	$100,093,828
Passenger earnings	31,231,338	27,392,393
Gross earnings	148,239,882	133,921,992
Maint. way and structures	17,060,498	15,121,800
Maint. of equipment	26,201,245	24,363,199
Conducting transportation:		
Traffic	1,772,012	1,435,417
Operation	53,504,168	49,473,234
Operating expenses	101,805,644	93,390,410
Net earnings.	46,434,238	40,531,582
Other income	12,784,262	12,136,918
Net income	35,674,301	30,102,518
Dividends	19,869,661	18,113,978
Payments account of principal of car trusts	4,246,039	3,249,238
Extraordinary expenditures	8,701,475	8,424,881
Transferred to extraordinary expenditure fund.	2,500,000	.....

CONTRIBUTIONS

Steel Ties on the Pennsylvania.

Philadelphia, March 13, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Relative to the report made of the recent accident to train No. 29 on the Pennsylvania Railroad in the vicinity of Mineral Point, full copy of which appeared in your issue of Friday, March 1, 1907, I think you have written a very fair and creditable editorial on the subject, including not only the Pennsylvania Railroad accident but the accident on the New York Central which occurred recently. The general impression seems to prevail, however, in nearly all the papers which have been brought to my observation that the steel cross ties for railroad track purposes are a failure.

I would be greatly obliged if you would call the attention of your readers to the fact that after most careful observation and study of the subject I am more than ever impressed with the necessity in the near future of a substitute for wooden cross ties, and so far no material has been offered as a substitute that will meet the requirements except metal. I think, however, that all ties tested are a little lighter than they should be and am firmly of the opinion that none of the fastenings for holding the rail in position to the tie is adequate to the requirements. This was emphasized in the accident we had, above referred to.

When any suitable fastening shall have been designed, and there is no doubt in my mind that it will be in the near future, either by the Carnegie Steel Company or by someone else, I have not the slightest doubt that the experiments in connection with the steel ties will go forward, not only on this system but on other leading railroads.

On the Pennsylvania Railroad alone we are using about 4,000,000 cross ties a year, and with the increased price for cross ties in the last five years and the difficulty in purchasing even at the increased price, it is obvious that some substitute must be secured before long. The quality of the timber also has depreciated enormously in the last five years, so that it becomes imperative that we should either purchase the best cross ties that the market affords and creosote these ties and use heavy tie-plates, or secure a steel cross tie or one of some other composition which will answer the requirements.

This company a number of years ago laid four sections of track with the steel tie as used at that time by some of the English railroads. These were of the inverted trough design, but did not give satisfactory results.

What I am afraid of is that the general public, and the engineering profession in particular, will dismiss the subject of steel ties as a failure, when in reality they must come sooner or later, and the more intelligent thought given to this matter the sooner a suitable steel tie will be furnished which will be satisfactory in every particular.

A. C. SHAND,
Chief Engineer, Pennsylvania Railroad.

A consular report from Nagasaki, Japan, says that the government will build three lines of road in addition to those to be built in accordance with the 15-year plan recently given out. The additional lines will be as follows: Kumamoto to Oita, 84 miles; Oita to Miyazaki, 181 miles, and Miyazaki to Yoshimatsu, 47 miles. The estimated cost is $20,734,000, and it is probable that the work will begin soon.

New Railroad Laws in 10 States.

The *Wall Street Journal*, in its issue of March 18, prints a summary of railroad legislation recently enacted or discussed, in most of the states where railroad laws have been proposed, from which we make below liberal extracts. It will be seen that many drastic laws have already been passed, and two-cent fare bills have been passed by Ohio, Kansas and Missouri, and similar bills are pending in New York, Pennsylvania, Michigan, Illinois, Texas and Minnesota.

New York.—The usual number and variety of bills have been introduced. The great majority are still in committees' hands. It seems unlikely that the more drastic of these bills will pass. Thus far, none of the so-called anti-railroad measures have passed both houses. There are several two-cent fare bills, but until the public utilities bill (general railroad law) has been disposed of none of the pending railroad legislation will be sent to the Governor.

Pennsylvania.—During the present session 48 bills affecting steam and trolley railroads have been introduced. The opinion is freely expressed both by legislators and railroad men that a two-cent passenger rate bill will be passed. Chances also favor a railroad commission bill becoming a law. The house has already passed the two-cent bill. The House committee has reported favorably on the Dunsmore bill to create a State Railroad Commission. Under its provisions the law will take effect May 1 and five commissioners are to get $6,000 a year.

Illinois.—No anti-railroad law has passed the legislature, but several will be passed. Over 60 bills are pending, many of them, however, largely duplicates. The most important bill to pass will be the two-cent fare measure. The next most important will be the employers' liability bill. No anti-pass bill will go through. Bills are pending on the following: Two-cent fare, seven in the House, one in the Senate; anti-pass, four in the House, two in the Senate; employers' liability, personal injury, reciprocal demurrage, live stock train speed, power to the railroad commission to enforce uniform accounting, grade crossings; taxation, outside of the Illinois Central matter, one in the House, giving power to the Railroad Commission to inquire into the subject. There are nine House bills and five Senate bills regarding accidents and protection to the public.

Politics and hostility between Governor Deneen and the anti-Deneen factions make the outlook very uncertain. It is impossible to say what railroad bills will pass, but there will be some kind of legislation. Governor Deneen also intends to have a bill introduced limiting the right of railroads to issue new capital.

The Governor wishes to leave the two-cent fare matter in the hands of the Railroad Commission, which now has sufficient power. Public sentiment is stronger than ever for passenger fare legislation since Indiana passed the two-cent fare bill. The Illinois law will probably give the railroads an opportunity to show the Railroad Commission whether a two-cent maximum is reasonable.

Minnesota.—Nothing seriously hostile has been enacted in this state, but several bills have passed the House and are now before the Senate. Many others, some very drastic, are pending in the House. There are bills for a tax on iron ore; for an income tax, applicable to persons and corporations; raising the tax on telephone, telegraph, express and private freight lines; imposing a license upon foreign corporations doing business in Minnesota; taxing transactions in grain and produce; and for raising railroad gross earnings tax from 4 per cent. (two bills, the Spooner bill to make it 6 per cent., and the Miller bill to make it 5 per cent.). The reciprocal demurrage bill has passed the House, but it is likely to be killed in the Senate. The two-cent passenger fare bill is likely to be compromised by concessions on the part of the railroads. The distance tariff bill, the bill for state supervision of railroad bond issues, and the bill requiring all corporations to make reports to the state auditor were killed. There are nine other minor bills covering loading of live stock, safety appliances and other railroad matters.

Legislative committees are investigating the alleged coal, timber and iron ore trusts, the harvester trust, the Hill ore land deal, and the matter of putting a valuation on railroad properties in the state and regulating rates accordingly. The Railroad and Warehouse Commission has reduced freight rates and the railroads are fighting it in the courts. The attorney general is suing the Great Northern for payment of back taxes on gross earnings, the Great Northern claiming that 3 per cent. is guaranteed by the charter, while the present advanced rate is 4 per cent. The attorney general is therefore seeking to annul the charter of the St. Paul, Minneapolis & Manitoba, the basic company of the Great Northern. The attorney general has also secured an injunction preventing the Great Northern issue of $60,000,000 new stock, on which a supreme court decision may be expected at any time.

Texas.—The anti-free pass bill will go to the Governor for approval at once. The bill reducing passenger fares to two cents has been reported favorably by the Senate and House committees, but there is a prospect of the measure not passing the Senate. A bill providing for reciprocal demurrage is pending in the House and Sen-

ate, requiring perishable freight to be moved not less than 265 miles a day and that all cars shall be moved at least 60 miles per day.

A bill requiring railroads to equip all of their locomotives with electric headlights has been passed. A bill prohibiting blacklisting of discharged employees by railroads is pending in both houses. A bill authorizing railroads to issue bonds to buy equipment is pending in the Senate, and a bill authorizing the Railroad Commission to require railroads to buy additional rolling stock when it is deemed such is needed has been reported favorably by the House and Senate committees.

Georgia.—Railroad laws will be passed in July for the supervision of bond and stock issues, and prohibiting free passes, campaign contributions and lobbying. The power of the Commission will be enlarged to compel the construction of side tracks. The state-owned road, the Western & Atlantic, now leased to the Nashville, Chattanooga & St. Louis, will probably be extended to the sea, 300 miles, the extension to be operated by the state.

Michigan.—The rate bill compelling railroads earning $1,000 a mile and over to give two-cent fares has been introduced in the Senate and is favored by the Governor. A bill is being drawn by the Michigan Manufacturers' Association for the formation of a Railroad Commission of three members, with powers similar to those of the Interstate Commerce Commission, as to the regulation of freight rates, etc. A bill has been introduced on reciprocal demurrage. The reciprocal demurrage feature is included in the commission measure, but was repudiated after a hearing, though it may be restored later.

Under the law of 1889, lower peninsula roads, whose gross earnings are $3,000 a mile or upward, must carry passengers at 2 cents; those earning $2,000 to $2,999 a mile, at 2½ cents, and roads earning less than $2,000 a mile may charge 3 cents. Upper peninsula roads, owing to sparse population, were not then included. Many legislators favor Senator Wetmore's idea of further reduction of fares based on earnings. They believe the minimum gross, warranting 2 cents a mile in the lower peninsula and 2½ cents a mile in the upper peninsula, should be $1,500 a mile.

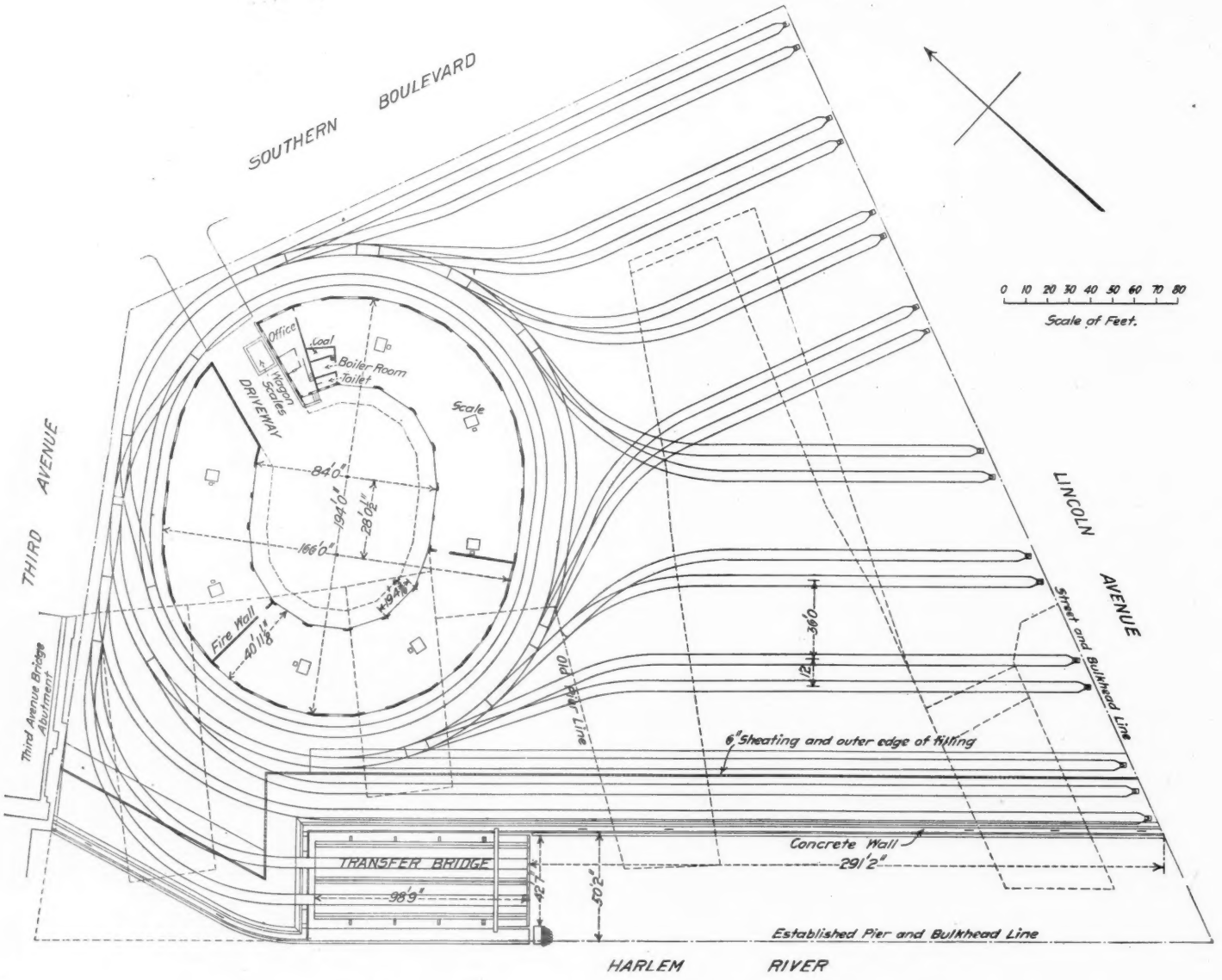
Missouri.—The only legislation passed by the present legislature was a two-cent passenger fare bill signed by Governor Folk February 28. This fixes a two-cent flat rate on all main line railroads. Independent and branch lines under 45 miles in length may charge the old rate, four cents. The former rate on the main lines was three cents. Other legislation has made changes in some freight rates established by the law of 1905. No other legislation is before the legislature that will especially affect railroads.

Wisconsin.—The legal rate of railroad fare in Wisconsin has been 3 cents a mile since the seventies. The State Railroad Rate Commission recently made an order requiring a 2½-cent rate on the principal lines, which has been accepted by the roads and is in force. Smaller lines will have to follow. The Commission recommended the sale of 500-mile books for $10, and the roads are now selling them. Half a dozen bills are before the Wisconsin legislature for a 2-cent rate, but the reduction to 2½ cents and the sale of mileage books at 2 cents has practically killed them.

Kansas.—The Kansas legislature has adjourned. Seventy-three railroad bills were introduced. Of these, 10 were passed, as follows: To prohibit passes; to reduce grain rates 15 per cent.; to limit the hours of trainmen to 16 a day; to require that freight trains be run 15 miles an hour; to prohibit the confiscation of coal; to increase the power of the railroad board; to authorize the state board to intervene in interstate commerce cases; to provide for reciprocal demurrage charges; to authorize the state board to establish terminals; to require railroads to furnish sheds for employees; and to sell 500 miles of transportation for $10.

New Bronx Freight Terminal of the Central Railroad of New Jersey.

The Central Railroad of New Jersey is building a somewhat unique freight terminal and transfer station on an irregular shaped piece of ground between Third and Lincoln avenues on the north bank of the Harlem river, New York. In order to utilize to the greatest advantage all of the small available ground space an ellip-



Plan of New Bronx Freight Terminal of the Central Railroad of New Jersey.

tical freight house is to be built, 194 ft. x 166 ft. over all. This scheme, while it involves the use of very sharp curves in the yard, has proved successful in the terminal of the Harlem Transfer Co. a short distance up the river, which was designed by Mr. Walter G. Berg, Chief Engineer of the Lehigh Valley.

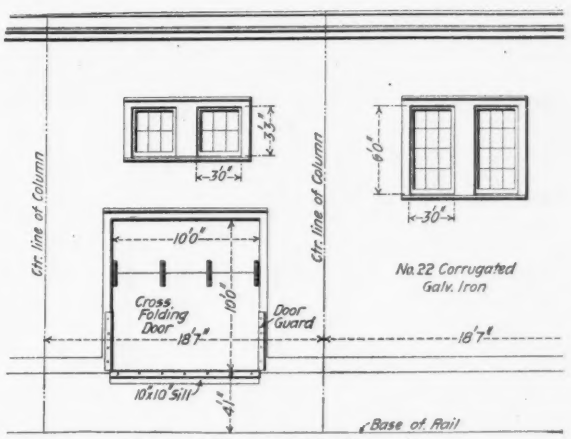
The yard is built on made ground which is retained on the river side by a wall of 6-in. sheathing, outside of which is a concrete sea wall. The transfer bridge, of the usual timber pontoon type, is parallel to the sea wall and the tracks leading from it turn on curves of about 85 ft. radius to the running track parallel to Third avenue. Barges moored to the bridge lie entirely inside the established pier head line. The running track entirely surrounds the house outside of the house track and connects with all of the stub team tracks on the east side of the yard. These stub tracks are laid in pairs with 36-ft. driveways between and the approach curves connecting them to the running track are from 90 ft. to 95 ft. radius.

The freight house is of fireproof construction with steel columns and roof framing and corrugated galvanized iron sides. It rests on concrete foundations supported on piling and is roofed with four-ply slag roofing. The roof slopes to the inner circle and the water is carried off by a gutter at the eaves. As a protection to teams backed up against the house a continuous canopy supported by light structural steel brackets extends completely around the inner circle. There is no canopy or platform on the track side.

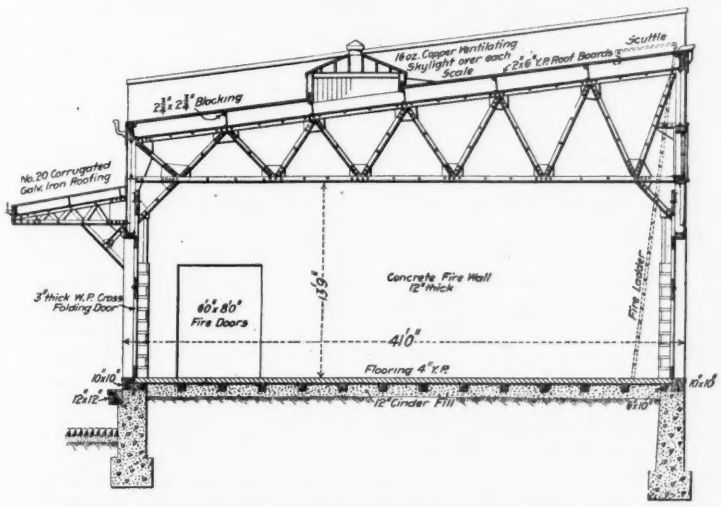
The office is two stories high and is located at the end of the house on the east side of the entrance driveway. Wagon scales are provided in the driveway, which can be read from the office. The main part of the house, which is 41 ft. wide, is divided up into three sections by 12-in. concrete fire walls extending up to the roof. The floor is 4-in. yellow pine laid on 6-in. x 6-in. stringers bedded in 12 in. of cinder filling. There are seven floor scales provided and over each scale is a ventilating skylight in the roof. The door openings on both sides of the house are 10 ft. x 10 ft., and they are closed by Cross folding doors made of 3-in. planks covered with galvanized iron.

We are indebted to Mr. J. O. Osgood, Chief Engineer, Central Railroad of New Jersey, for the drawings.

Part Elevation of Driveway Side of Freight House.



Part of Track Side Elevation.



Cross-Section Through Freight House.

New and Old Signaling Problems.*

The serious accidents that have recently occurred have so attracted the attention of the public, there is an evident demand for the Interstate Commerce Commission to take up the subject of railroad operation and compel the adoption of a form of block system by which it is expected that many accidents will be prevented. There are few who will deny that a block system, however weak, would not be of some advantage in reducing the number of accidents; but will the commission, in prescribing rules and regulations, take cognizance of the many unsolved problems in signaling, and say what should be considered good and what bad practice? If all roads are required to install the safest and most complete system possible, the expense will be a heavy burden on many, not only in first cost but for maintenance. On the other hand, should not the commission be held, with the railroads, partly responsible for accidents which occur through defects existing in a system of which the commission has approved? To what extent can the commission consistently approve of or require the observance of certain block signal rules and regulations, without being criticized for having sanctioned a system which does not give complete protection?

The Board of Trade of England has prescribed an elaborate set of rules and regulations regarding signaling, which the roads must live up to; and new roads may not commence operation until the prescribed signal system has been installed and is in working order. The Staff system is prescribed for single-track roads, and while insuring almost complete protection against collision from head-on movements, such delay is caused in the running of fast non-stop trains that few can be run where this system is installed. Double-track lines, with all movements made in the same direction on a given track, are therefore more often the rule than the exception. In this country but a small part of the total mileage has been double-tracked, while on the single-track lines there are many and heavy fast trains run. For many of these roads double-tracking is out of the question from a financial standpoint, and the Staff system, with its limitations on the speed of trains, seems to be equally impossible.

There are many block systems, more or less complete, which may be used for single and double-track lines, and in approving of the use of any system, the points affecting the safe movements of trains should be carefully considered. On many of these points signal engineers do not agree, and definite action has not been taken by the Signal Association. The questions involved are so closely connected with operation, a discussion by those not particularly interested in the details of construction will aid in the determination of the best practice and the necessity of the same being observed by those who may not at the present time be conforming thereto.

Of several of the questions here submitted much might be said, but the purpose of this article will be served if definite recommendations are made by the club for the benefit of those who are interested in signaling; and to this end possible conclusions to the several questions have been suggested.

1. The question, "Shall a distinctive color be used for the 'clear' night-signal indication, or shall the white light be continued in use?" is one with which all are familiar. The possibility of a glass breaking and a wrong indication being given is so great, and the chance that a white street or house-light might be mistaken for the signal-light has increased to such an extent with the introduction of electric lights, a change to a colored light for the "clear" night indication seems to be necessary, if reasonably safe operation is to be secured. The Signal Association has recommended that a change be made, and several large roads are using green for the clear night indication. The glass makers have so improved their product, an excellent green can now be had. Although the yellow used for the

*A paper by W. H. Elliott, of the Engineering Department of the New York Central, read before the New England Railroad Club, March 12.

cautionary indication is not all that is desired, it is sufficiently distinguishable from the red on the one hand and the white on the other to answer as a satisfactory cautionary color. In the interest of greater safety in operation it is to be recommended that roads which are now using white should change to green for the clear, and to yellow for the cautionary night-signal indications.

2. Are continuous track circuits necessary for a sure-working block system? Judging from the apparently successful block working of thousands of miles of roads which are not equipped with track circuits, it would appear that a track circuit was not a necessary safeguard. However, an examination of the record shows that on roads that are protected by manually operated block signals, many accidents have occurred which would have been prevented if the working of the signals had been controlled by a track circuit. With the telegraphic block system, accidents have happened from the following causes, which in many cases would have been prevented if a track circuit had been used to control the working of the manually operated signal.

The signal may be allowed to remain at clear after the train has entered the block, and the indication be accepted by a second train.

The signal may be cleared for a train to enter the block when it is occupied.

On single track, trains traveling in opposite directions may be allowed to enter the block at the same time.

Switches in the block may be left wrong, or a switch may be opened and a train run out on the main track ahead of one approaching, or while there is a train in the block.

With the controlled manual system, accidents may happen from any one of the following causes through two trains getting into the block at the same time—a condition that would have been prevented by the use of the track circuit.

The releasing section may be shunted by an uninsulated handcar, a tamping-bar, or by the man cleaning batteries, the lock being thereby released and permitting the clearing of the signal when there was a train in the block.

The unlock may not be taken up when a train enters the block, and it would then be possible for the signalman to improperly clear the signal.

Should, at any time, under permissive card or on account of failure of the system, two trains be permitted to enter the block at the same time, the passage of the first train out of the block would release the instrument and allow the signals to be cleared for the entrance of a third train while the second train was yet in the block.

Should the rear portion of a train be left in the block, the passing out of the head end would release the block instrument, and the signals could be cleared for a train to enter the block that was occupied by a part of a train.

With continuous track circuits installed and thus permitting of the signals being made semi-automatic, the signals would automatically change to the stop position when a train entered the block, and would be held in such position as long as the block was occupied. As this protection is very necessary, and can be secured in no other way than by the use of the track circuit, this apparatus should properly be considered as a necessary part of a sure-working block system.

3. With the wide heads of the heavy rails now in use, is it not advisable to take the detector bars off and depend upon electric locks controlled by track circuits to hold the interlocking levers and prevent a switch being thrown under a train? This is, comparatively speaking, a new problem, and has arisen from the fact that with the 90 and 100-lb. rails the tread of the wheel does not often project over the outside of the head of the rail sufficiently to catch the detector bar and prevent it from going over. This is particularly the case where there is a sharp flanged wheel, or the track is not exactly to gage; and when the bar is allowed to go over, the switch is unlocked and may be thrown under the train should the lever be pulled by the signalman. The size of rails will not be made smaller as engines and cars get heavier, and it is desirable that some more efficient means than the detector bar be provided to prevent the throwing of a switch under a train. The track circuit controlling an electric lock on the switch lever seems to provide the required protection and to be surer working than the detector bar. This is because the shunting of the track circuit is automatic, and once having operated is positive in its action and cannot be forced by a pull on the lever.

The weak point in the arrangement is that the relay may not be shunted; but with a magnet of sufficiently high resistance to make the relay quick acting, and with the ends of the circuit properly located with reference to the position of the switch, the electric lock has been found to be the most reliable and to give the best protection.

4. Do automatic signals give sufficient protection to require their installation as necessary for the safe movement of trains on a single-track road? This is an important question, and more may easily be said upon the subject than can be given here. In the United States the telegraphic block system is the one most generally employed for the protection of trains on single-track lines. Where greater protection is required the automatic is the system usually put in. When installed in the right way, with the signals for opposing movements staggered and also placed on each side of a main-line switch to protect trains entering or leaving the switch, the automatic system furnishes a large degree of protection, although the movement of traffic is assisted in comparatively small proportion for the outlay of money required.

In no instance with which the writer is familiar have distant signals for each home signal been provided for a large installation on a single-track line, and complete protection cannot be obtained without these. It is true in most cases that the distant signals have not been used on account of the complicated wiring required, rather than because of the expense; but to do without the distant signal is to dispense with an important part of a signal system without which it is difficult to require enginemen to obey the indications of the signals. The distant signal gives notice to an engineman when a stop is to be made at a home signal, and without this notice the engineman cannot be expected to come to a stop at the signal unless the signal can be seen from the point at which the brakes should be applied. In bad weather the signal cannot be seen very far away, and if a train is running at high speed and the signal is indicating stop, the train will run by the signal before it can be brought to a stop. Allowing an engineman to constantly pass a signal indicating stop, when he should not, weakens discipline; and the signal is likely to be run by once too often and a collision result.

On single-track lines it is necessary for a train finding a signal indicating stop, to send a flag ahead before proceeding, as the signal may be indicating stop on account of a train approaching from the opposite direction. Great delay is therefore occasioned when the system fails, and traffic is materially interfered with. This the public will say is on the side of safety, but when an important train loses 15 or 20 minutes being flagged through a block on account of a failure of the signal system, the schedules are often so disarranged the chances are increased for a mistake to be made in orders or in meeting points.

The automatic system on single-track lines is of assistance in expediting movements where the trains are moving in the same direction; and where traffic is heavy or the conditions of operation difficult, its installation would seem to be warranted. Where the operating conditions are good and traffic is light, with the possibility of making the blocks of equal length, the necessity for the use of automatic signals is not so apparent. For those roads where the number of trains approaches the maximum it is possible to run, it will sometimes be found a better proposition to double-track the line rather than go to the expense of installing automatic signals; so that, before coming to a decision as to the advisability of installing these signals, it will be well to consider the matter from the standpoint of a possible elimination of, rather than protection against, the dangers due to trains moving in opposite directions on the same track.

5. Where automatic block signals are in use, is it necessary for a man to go back to flag following trains? Mr. Slater, of the Southern Pacific, brought the matter to the attention of the Signal Association, and argued that it was not necessary for a man to go further back than to know that the first signal in the rear of the train was indicating stop; and on leaving torpedoes the man should return to his train. The flagging rule No. 99 is probably more honored in the breach than in its observance, for with many trains, if the rule was fully obeyed, the flagman and then others of the train crew would be left behind until there was no one to flag, or else no one to run the train. The question of when to flag and when not to flag has to be decided by the man on the ground, but in a number of cases this man finds it unnecessary to flag; and often, when he thinks there will not be a train closely following, he remains with his train rather than to go back. In practice, if there are many trains run on a given track, complete flagging protection is not possible; for trains make stops at stations as well as between stations, and an accident is as likely to occur at small stations as at other places, because it is not practicable for a fast train to approach each station prepared to stop. Dependence must therefore be placed on the block signals for protection. Where the blocks are long and the trains are infrequent, the necessity for flagging is more apparent, and the men can be depended upon to more fully observe the rule. If, as seems to be true, there are places where the flagging rule cannot be strictly observed, is it not time to recognize this condition and so change the rule that it will not be held over the flagman's head to convict him when there is an accident, and to be overlooked as long as trains are running satisfactorily? Will not the position of the Superintendent be more consistent and better discipline be secured if, at places where a reliable block system is installed, the flagman is required only to assure himself that the first home signal in the rear is indicating stop, and after doing this and putting down torpedoes should be permitted to return to his train? Will not such practice

cause the engineman to more properly obey the indication of the signal and proceed with caution when entering a block that presumably is occupied, than for him to depend on a flagman being out to stop him in case there is a train in the block?

The automatic is of necessity a permissive signal, and trains coming to a stop at the signal must be allowed to proceed. While an engineman may disobey the rule and run at too high speed, thereby coming into a collision with a train in the block, the fault is certainly the engineman's and shows a lack of discipline; for not only should the train have been run so as to make it possible to stop within the space to be seen ahead, but it should not have been run any faster than would be safe were there a broken rail that might derail the engine. Strict discipline will have to be imposed, but it will probably be found as easy to do this and get satisfactory results as it is to get the men to live up to the requirements of the flagging rule. It would seem, therefore, that where the modern complete system of automatic block signals is installed, the protection afforded by the signals should be recognized and the flagging rule changed to such an extent that the benefits to be had from the use of the signals might be fully taken advantage of.

6. Is the use of approach locking warranted, with its complications, delays to traffic and increased cost of installation and maintenance? The need of an approach lock, by which the route through an interlocking plant is locked when the signal is cleared, and cannot be changed until the train has passed the signal, is most generally shown in the investigations that are made into the causes of derailments or accidents resulting from the home signal being improperly run by. In almost every case of the kind, the train crew apparently at fault will claim that the route was taken away after the signal had been cleared for the train to proceed. In the majority of these cases it is the word of the signalman or men against that of the engineer and fireman, and occasionally also that of the head brakeman and the conductor. The Superintendent is almost always inclined to take the word of the trainmen as against the signalman, and even if such is not the case the mere possibility of the route being changed throws a doubt on the finding of the investigation, unless a device is in use that would prevent the changing of the route in the face of an approaching train. The possibility of the route being changed, either through carelessness, poor judgment or undue excitement on the part of the signalmen, will always exist unless a lock is used to prevent a change being made. As generally applied, the lock takes effect when the home signal is cleared, provided an approaching train is within a certain distance of the distant signal. If a train is not approaching, the signal may be cleared and returned to the stop position at will, as it is the presence of the train that drops the lock and holds the route. The lock becomes effective only when the lever has been reversed, and while the lever may be returned to the normal position at any time, the latch is held by the lock and the route cannot be changed until the head end of the train has passed the home signal and arrived at the point where the route should be released.

Where the approach lock is used it is usual to provide a screw release which will, in case of emergency, allow the route to be changed, provided a certain determined period of time is taken to effect the release. The time required for the release is generally made one and one-half minutes; and as the first turn cannot be given to the screw until the home signal has been put to the stop position, an approaching train would have time to pass the signal and hold the route, or to have come to a stop at the signal before the route could be changed. In view of the many fast trains that are run, the added safety and the better discipline to be obtained through the use of the approach lock, it would appear that the additional maintenance and the delays to traffic resulting are unimportant in comparison, and the use of approach locking is to be recommended.

7. What interlocking signal protection should be provided for a drawbridge to insure that all parts are in proper position, and is it safe for trains to pass over the bridge without stopping? It has usually been considered that sufficient protection was provided when the bridge itself was locked in place before allowing the signal to be cleared, but the several derailments that have occurred have shown that it is as necessary to lock the lift rails in place as it is the points of a facing switch. Safe working can be secured only by providing complete interlocking protection and the elimination of the human element as far as possible. Complete interlocking protection requires that the bridge must be in place and the lift rails locked in position before the signal can be cleared. Also, that the signals must be automatically controlled in addition to the normal control provided by the lever of the interlocking machine. This is necessary, as the locking of the machine might be tampered with or the indication locks picked and the signal improperly cleared, unless some other control was provided. Automatic control of the signal is obtained by means of a track circuit and circuit controller, the latter being connected to and operated by each lift rail of the track governed by the signal, so that the circuit to the slot on the signal is broken unless the lift rails are in place and the track unoccupied.

8. Has the automatic stop been so perfected that it may be considered sufficiently reliable to warrant its use, and if used would the number of accidents have been materially reduced? It is probable that as many patents have been issued for automatic stop devices as for any other apparatus in use on a railroad. While the stop is successfully used on elevated and protected subway roads, it has not been sufficiently developed to warrant its application to a steam surface railroad. The principal difficulty in perfecting the device is, to transmit to the moving train the impulse or energy required to shut off the propelling power and apply the brakes when the signal has been improperly run by. With a mechanical device snow and ice will either operate or knock the stop out of place, while with apparatus of the electric type it is difficult to make connection between the operating circuit and devices on the engine and the controlling circuit on the track. With either type of apparatus the device has been arranged on the normally open circuit plan, by which a breakage of important parts will cause the giving of a clear indication when the brakes should have been applied by the stop.

The automatic stop appears to be practicable only for those tracks on which trains are run in the same direction. The use of an overlap is also required. To serve the purpose for which it was designed, the stop must bring the train to a stop before it has come into collision with another. There must, therefore, be a clear track in advance of each signal for a space equal to the braking distance, and this the overlap provides. The use of the overlap and the difficulty of so arranging the apparatus that the brakes shall be applied when a train is moving in the direction of traffic, and not be applied when backing up, makes it evident that switching and irregular train movements will be materially interfered with. While it is absolutely necessary that trains should be moved as safely as the state of the art will permit, it is as necessary that trains shall be allowed to run and make schedule time when there are no other trains in the way. That this is so is evidenced by the frequent complaints made by passengers.

It is not to be denied that several of the collisions occurring during the last year would have been prevented had a sure-working stop been used, and it is probable that if a stop should be developed to the extent of being reasonably reliable, it would be used for certain classes of traffic. On the other hand, the use of the stop may have the effect of reducing the attention engineers pay to signals, in which case it would be better to go without the stop than to use it. It is also probable that the use of a stop would transfer in a large measure the responsibility for the observance of the indication of a signal, from the engineman, who is usually an educated man and well paid, to the repairman, who is comparatively speaking not as good a man, and could not be held to the same degree of responsibility. In so far as the responsibility of the engineman is reduced, to that extent it is objectionable to use the stop.

9. Is it advisable to use an overlap and insure a clear section of track ahead of a home signal, equal in length to the braking distance, in which an engineman may be given a chance to stop after passing a home signal and before coming into collision with a train that may be on the track ahead? Without an overlap an engineman must act on the indication of the distant signal to insure against colliding with another train. With an overlap, it is possible for the engineman to stop his train before hitting another train, although the brakes were applied only when the train passed the home signal. The engineman is therefore given two chances in which to bring the train safely to a stop. If the indication of the distant signal with its yellow or green light is overlooked, the probabilities are that the red, which is a more distinctive light, will be observed. Conservative railroading evidently calls for the use of the overlap, as it does that a derail [at a crossing] should be placed far enough back from the fouling point for the derailed train to be brought to a stop before reaching the line it was desired to protect. Men are fallible, and mistakes are made through carelessness or errors in judgment; and unless a certain space is provided in which a train may be stopped after reaching the signal, the chances are that a slight running by of a signal through an error in judgment will result in an accident that would not have occurred if the overlap had been used.

10. Of what length should the blocks be made when a road is signaled for a maximum traffic? This is an important question, in view of the necessity of operating trains safely in the crowded terminals of our large cities. A train may be safely run at a given speed, other conditions permitting, when the engineman is given warning at a point far enough away to enable him to bring the train to a stop before passing the stopping point. The distant signal is the warning point and the home signal the stopping point. Unless there are to be two distant signals for each home signal, a practice that is not to be recommended, the space between the distant signal and the home signal is therefore the shortest length of block that may safely be used. The space to be provided between the distant and the home signal is a matter of the speed of the train, the braking power and the grade of the track; and when

the signals are arranged to suit the conditions existing at a given point, the blocks will be as short as it is safe to make them, and the maximum traffic will be provided for.

11. In arranging signals to indicate the speeds that may be safely run, are the principles of route signaling, as understood at the present time, to be ignored? Speed signaling, as recommended by a committee of the Signal Association, calls for three arms to be provided on all interlocking home signal poles, of which the upper arm will govern for train movements to be made on an unlimited speed route, the second arm to the limited speed route and the third and lowest arm to the diverging, slow-speed and all other routes. The three arms are to be provided on all home signals, although it may be possible that only one or two of the arms may be used. By arranging the signals as proposed, the speed that may be safely run will be indicated; and the engineman will not have to remember the particular route a given signal stands for or the speed that may be run. That such an arrangement of signaling has much to commend it has been shown by the many places where it is used. On the other hand, it is often desirable and important for an engineman to be informed of the particular route set. If it is the main-line route that is set, long practice has required that the upper arm be used to indicate this route, irrespective of whether or not it was the one on which the highest speed might be made. The main route may be one on which there is a sharp curve requiring reduced speed, while the diverging route might be the straight track, so that in certain situations the arm used for the main-line route with speed signaling will not be the same as when signaling for a particular route. The use of the upper arm for the main-line route has shown that it is safe to require the engineman to recognize the location and govern the speed accordingly, and where there is more than one route on which high speed can be made, additional arms may be used for such tracks and practically the same results secured as for high-speed signaling. This is particularly the case at terminals where the speeds are slow, and it is important to indicate to an engineman when the route is set for the straight track or a particular route, thereby making use of all of the arms on a pole, rather than not to be able to clear the top arm because there was no unlimited speed route. The more extensive trial of speed signaling now being made will probably show that it is more important to signal for the route set, and where the two arrangements do not conflict the signals may be understood as indicating the possible speed and the route set.

12. Are electric roads to be allowed to cross steam roads at grade without providing sufficient power return conductor to keep the current from flowing along the rails of the steam roads? It is not desirable to retard or stop the growth of electric roads, but the safe operation desired by the steam road requires that crossings of the two roads at grade should not be permitted. If, however, a crossing is to be made at grade, it is reasonable to require an electric road desiring the crossing to so equip its line that the safe operation of the steam road will not be interfered with. Where automatic signals are in use they are usually controlled by a track circuit operated from a battery of low potential, to avoid excessive leakage and consequent failures. Where the rails of the electric line are used for the return of current to the power house, pressure or voltage is required to cause the current to flow. The pressure required to cause a certain flow is proportional to the resistance; the higher the resistance, the greater the pressure necessary to return a given current to the power house. If there are other paths than the rails of the electric line for the current to take on its return to the power house, the current flowing through these will be proportional to the resistance through these paths and the resistance in the rail return of the electric line. Consequently, if the resistance of the return on the electric line is not kept at a low point in proportion to possible other paths, current enough to interfere with track circuit relays controlling the automatic signals will flow along the rails of the steam road. The safe operation of the steam road depends upon the automatic signals working properly and not giving a wrong indication, and it is necessary that no current from the electric line be allowed to flow along the rails of the steam road. As this may be prevented only by providing sufficient return conductor capacity, the electric line might reasonably and properly be required to put in sufficient conductor to protect from foreign current interference the working of the signals on the steam road.

13. When a steam road is electrified and the rails are used for return of propulsion current to the power house, what special form of track circuit is it necessary to use in order that these circuits will not be affected by the current used to move trains? The use of the track rails for the return of propulsion current makes it necessary to provide a continuous return path from the train to the power house, and it is not possible to divide the track into unconnected sections as is done when automatic signals are installed on a steam road. When direct current is used for propulsion, alternating current is made use of to operate the track circuit, the various sections of track being separated one from the other with the ordinary form of insulated joint. To permit the propulsion current to pass from one track section to the next, a reactance bond or coil is used to connect the ends of adjoining sections. While permitting the direct current to flow with no other than the ohmic resistance of the bond and its connections, which is about the same as that of a piece of rail of equal length, an appreciable resistance is offered by the bond to the flow of alternating current, owing to the reactance of one turn upon the other of the coil which is made around an iron core. By making the copper wire of the bond large enough to carry without injurious heating the heaviest current the power house may furnish, the direct current will be allowed to pass uninterruptedly while the alternating current will be limited to the track circuit section, causing it to operate the track relay and control the signal in the same manner as on a steam road.

Where alternating current is used to move trains, this same kind of current must also be used for the track circuit, and a reactance bond of the same general type as is required for the direct current propulsion system must be used to connect the rails of adjoining sections together. The alternating current generally used for propulsion purposes has a frequency of 25 cycles per second. The track circuit relay must therefore not be worked by the 25-cycle current, and a current of different frequency has to be used, with the relay so adjusted that it will be operated only by this current of different frequency. With a frequency of 60 or 160 cycles per second the rotative impulses or pull on the relay armature caused by the 25 and the 60-cycle current occur at such varying intervals of time that the relay will respond only to the higher frequency, and with the relay working properly the other parts of the signal system are made the same as for a steam road. It is probable the relay for the A. C. propulsion system will be more sensitive than for the D. C. system, owing to the propulsion current having a certain effect on the armature; but the trials which have been made of this relay show it to be reliable in its working, and it is possible to install a satisfactory automatic signal system on a road where an alternating current is the power used to move trains.

Suspension of Freight Transportation on the Hungarian Railroads.

On January 10, the management of the Hungarian railroads issued an order that affected the whole commerce of the country. Starting from that date all transportation into Budapest with the exception of that of live stock, salt, coal and firewood, was suspended. No freight destined for Budapest was to be received, while that en route thither was stopped and placed at the order of the shipper. The order did not affect goods shipped from Budapest. The management stated that this order was necessitated by the enormous accumulation of merchandise at all of the stations; accumulations that have resulted from the delays to traffic that have occurred since Christmas. The decision for this action was taken suddenly on account of the congestion that threatened Budapest. The transportation of freight into Budapest has increased very greatly since autumn. The last order of this kind was issued in 1893. The transportation of passengers was not affected. The order naturally created some excitement in commercial circles, especially in view of a threatened strike by the railroad employees; and it was regarded as an attempt, on the part of the management, to retain the mastery of the situation.

A Bulletin of Traffic News for Shippers.

Arrangements have been made for publication in Chicago of a weekly bulletin intended to give manufacturers, shippers and others concise, reliable information regarding traffic affairs of the country —primarily information of freight tariff changes and other data taken from the records of the Interstate Commerce Commission. The new rate bill requires all tariffs to be filed with the Interstate Commerce Commission 30 days before going in effect. The object of the bulletin is to publish information about these new tariffs and place it in the hands of the shipper not later than seven days after filing, and therefore 23 days before becoming effective. This information will include the name of the road, the commodities, the territories affected, and when effective. The scheme, of course, requires the support and co-operation of the Interstate Commerce Commission. This has been obtained, and permission given for desk space in the Commission's offices in order that all tariffs filed may be examined readily. The plan further embraces the establishment of a rate bureau in Washington, which will be in charge of an expert traffic man, with competent assistants. In addition to examination of the freight tariffs, all complaints lodged with the Commission, and all decisions of the latter, will be digested for publication in the bulletin. For subscribers desiring immediate notification regarding rate changes, etc., there will be two additional services maintained, namely, telegraphic and mail.

The bulletin will also give news of railroad freight traffic associations, concerning their dockets, proposed changes in rates, clas-

sifications or routings, and the complaints or hearings before these associations. Another department will be devoted to shippers' and commercial association news, giving the subjects before such associations, the plans they have affecting transportation interests, and other information of value to shippers at large. Correspondents in the capitals of all states having railroad commissions will report the doings of each. Court decisions affecting traffic matters, changes in traffic officers on railroads, and in short all available information of interest on traffic matters is included in the plan for the bulletin. The publication will be 8 x 11, the size of a tariff sheet, for convenience of filing with the latter, and will be issued on Saturday of each week. It will contain the news of the week up to Friday. The Washington bureau will also be at the service of subscribers to obtain any information desired from the files of the Interstate Commerce Commission at a nominal cost.

The scheme is said to have the indorsement of such organizations as the Chicago Commercial Association, Illinois Manufacturers' Association, Chicago Board of Trade, and similar organizations in other large western centers such as Kansas City, Omaha, Milwaukee, Minneapolis, etc. The first number of the publication is expected to appear the last week in March under the name of the *Weekly Rate Bulletin*. The subscription price is $10 a year and the headquarters are in the Monadnock Building, Chicago.

So important is regarded the introduction of locomotives using superheated steam that the Prussian Ministry of Public Works has detailed Robert Garke, one of its high officers, to experiment with and report upon the performance of such engines; and that officer has recently published a large volume, which, after discussing the leading types of locomotives of recent construction in all countries, is largely devoted to the results of his experience with superheaters continued for ten years. The book says that last October there were in use or already ordered 1,646 locomtives with Schmidt superheaters, of which 875 were in Germany.

Reinforced Concrete Bridge Over the Cumberland River.

BY WARD BALDWIN.*

The Kentucky & Tennessee Railway runs from Stearns, Ky., on the Cincinnati, New Orleans & Texas Pacific southwest about 10 miles through extensive coal and timber lands controlled by the railroad company. The country is rough and some heavy construction work was necessary, the most important piece of engineering being the crossing of the Big South Fork of the Cumberland river, where a reinforced concrete arch bridge of five spans was built.

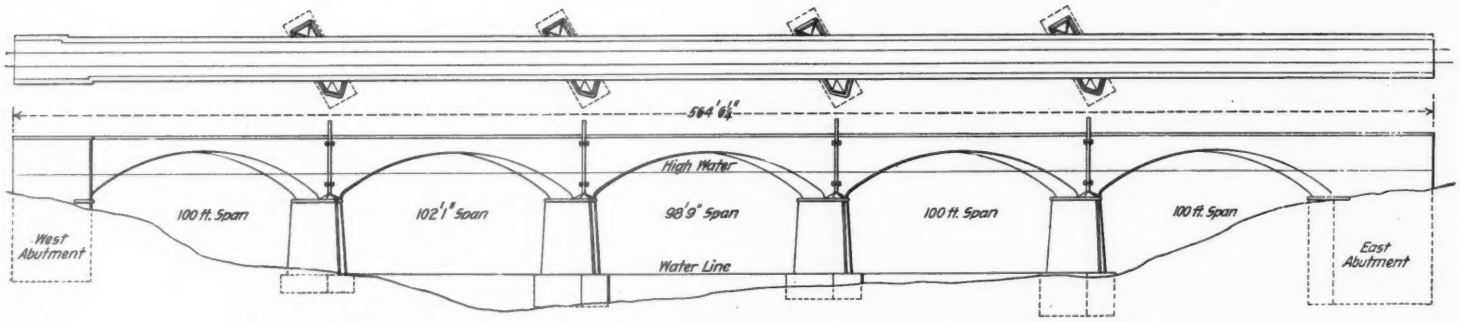
Reinforced Concrete Arch Bridge over the Big South Fork of the Cumberland River, Sept. 11, 1906.

The arches have a span of 100 ft. c. to c. of piers and a rise of 18 ft. with a clear height at low water level of 48.8 ft. They are parabolic with circular intrados and extrados and have a skew of 30 deg. A trainload equivalent to Cooper's E-40 was used in designing them. The reinforcement is twisted steel bars of the sizes and locations shown on the accompanying drawings. A mixture of 1:2:4 concrete was used for the arch rings and spandrel walls. Expansion joints are provided in the spandrel walls at the abutments, but the walls are continuous over the piers where the shear rods of the arch rings are extended into them.

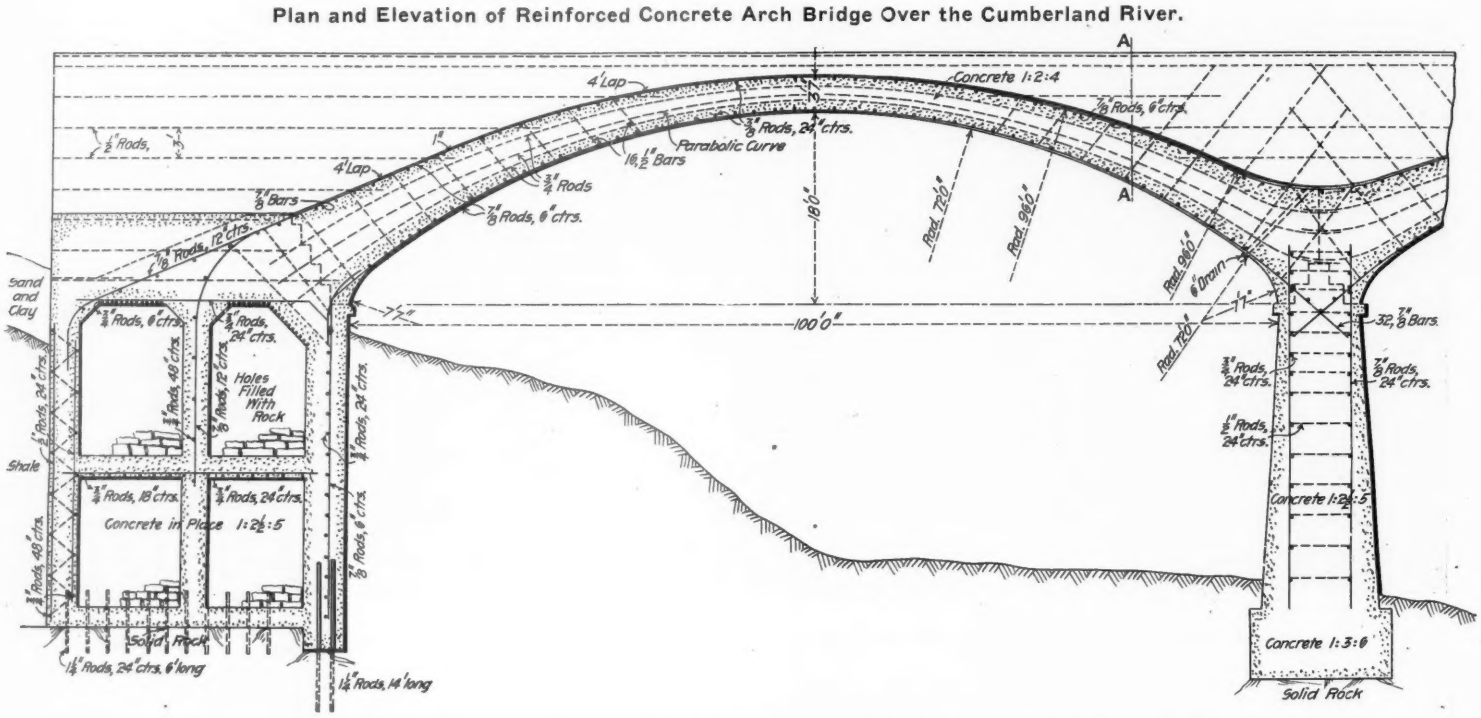
The west abutment was built hollow and filled with rock. It was designed on the supposition that solid rock which outcropped on the ground surface near the site of the abutment would be found at a small depth. Solid rock was not found, however, until El. 713 was reached and to avoid the cost of extending the abutment so that

*Consulting Engineer, 528 Walnut street, Cincinnati, Ohio.

Reinforced Concrete Arch Bridge over the Big South Fork of the Cumberland River, Feb. 1, 1907.



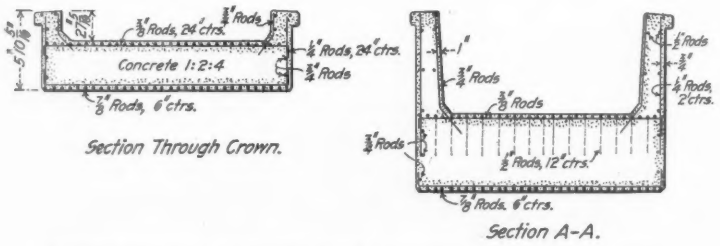
Plan and Elevation of Reinforced Concrete Arch Bridge Over the Cumberland River.



Longitudinal Section Through West Abutment and Arch Showing Reinforcement.

its weight would make it stable against the thrust of the arch, anchor were cemented into the rock foundation for a depth of 6 ft. along the front edge of the abutment. In building the west abutment it was found that the cost of the form work was greater than the saving in concrete and the contractor preferred to build the east abutment solid. This change in the plans was made and much of the steel reinforcement was omitted. The foundation of the east abutment is hard shale.

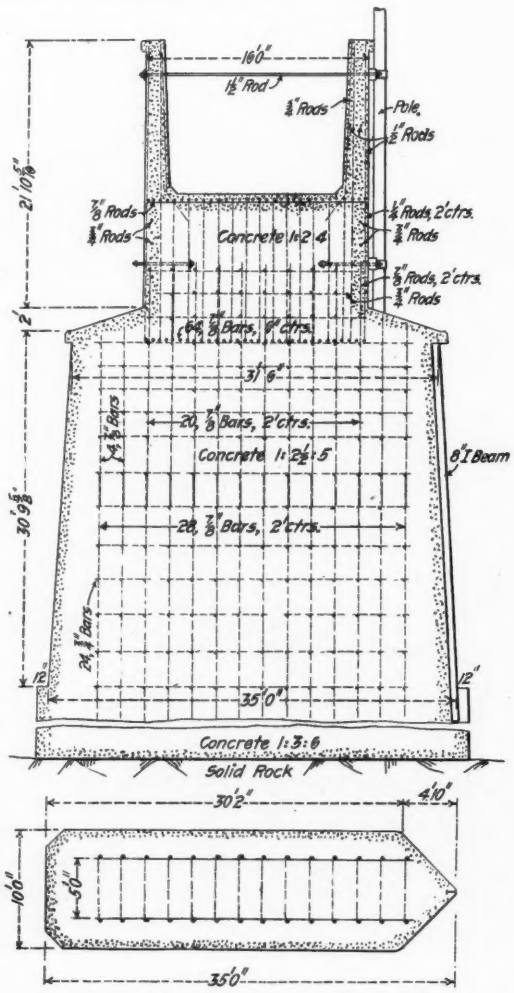
The piers contain some steel reinforcements and the nosings on the up-stream side are protected by steel I-beams set flush in the concrete. A 1:3:6 mixture of concrete was used in the footings and a 1:2½:5 mixture for the body. The foundations for the piers were sunk to bedrock inside of cofferdams made of a single timber box banked with earth on the outside. The site of the bridge is



Cross-Sections Through Arch; Cumberland River Bridge.

just above a riffle where the water has only a slight current at ordinary stages and no trouble was experienced with these cofferdams except in the case of the channel pier, where the water is about 14 ft. deep. The earth bank was washed away from this cofferdam a number of times during high water. The material for the piers and abutments was handled with skips running on a cableway and the material for the arches was handled by small dump cars run on a trestle supported by the arch centering. The entire structure contains 6,470 cu. yds. of concrete and 120 tons of steel reinforcement. Work was begun on the bridge in November, 1905, and the bridge was completed and opened for traffic in February, 1907.

The contractor for the bridge was the Collier Bridge Co., Indianapolis, Ind., but the contract was sublet to Samuel Dingle, who subsequently completed the work as the principal contractor. The



Details of Reinforcement in Piers.

general design was submitted by the Collier Bridge Co. with its proposal, but the details were developed in the writer's office by R. G. Walter.

Mr. Harriman on the Present Railroad Situation.

The following is an abstract of an interview with the President of the Union Pacific, published in the *New York Times*, in which Mr. Harriman discusses various features of the present railroad situation:

"There has got to be co-operation on the part of the railroads on the one hand and the public and the government on the other. We have tried the other methods. We have left it to our lawyers to take care of legislation by whatever means might be the most effective and to our subordinates to explain things to the general public. It won't do. We have produced a flood of legislation throughout the country, some of it of doubtful purpose and some the result of misdirected zeal inspired by the National administration, and if we are ever going to extricate the railroads we have got to come out in the open and tell the people the railroads' side of the matter.

"Take the situation when this Interstate Commerce Commission inquiry started. There were pending arrangements between several large corporations and foreign capitalists running into the tens of millions. These arrangements were on very favorable terms. As soon as the foreigners heard that the Interstate Commerce Commission was going after the Union Pacific they came to the conclusion that American corporations in general were in a pretty bad way, and negotiations were broken off. Now, if those arrangements had been completed it would have established a standard of credit for all good American enterprises that wanted to raise funds abroad. Moreover, the importation of the gold would have added four times its amount to the banking credits of the country. All that was stopped, for the time being, by the timidity of foreign capital, produced by the institution of the inquiry.

"Unquestionably the railroads are now facing a new era in their development, as distinct from that which has gone before as was the period of reorganization from that of rapid expansion which preceded it, or that of tremendous traffic development which has followed in the last seven or eight years. And that is the very reason why I believe it essential that the railroads and the public should reach a common understanding. If the railroads are unable to meet the further development of the country, they become fetters for the country's business interests. We can see the causes of this situation if we go back 15 or 20 years in railroad development.

"Back of 1893 for a decade there had been a period of rapid construction, the great period of railroad expansion as the country began to recover from the effects of the civil war. The railroads in that era unquestionably built beyond the ability of the country to support them. When a reversion of business came in the early nineties, as such things do come from time to time, here was all this railroad construction for which there was no corresponding demand. The receivership period was the logical result.

"Then we had the period of receiverships and reorganizations which was practically contemporaneous with the recovery of the country from the depression of 1893. But in that period practically nothing was done by the railroads to anticipate the future development of the country. They had all they could do holding their own and making ends meet after what had gone before. Now suddenly the country emerges from the years of business depression into six or eight years of the greatest development it has ever known. The railroads have been obliged to crowd into this period all the new work of providing new facilities that should have been distributed through as many years more preceding. And at the same time they have had to anticipate, so far as possible, future development of the country.

"They have been obliged to crowd into the last six or eight years a task of providing facilities that should have been spread over ten years preceding. The result is that they have fairly overlapped the facilities of the country to bring to them, with economy either to shipper or railroad, the goods which are to be carried. This is the all-important point for co-operation between the railroads and the public, for the failure to handle the business economically on the part of the shipper has generally been charged up against the railroads, while the railroads' inability to handle it economically has meant less effective service and a tendency to higher rates.

"Take an example: The other week I went up to Groton, Mass. I lived in my car while I was there, and I couldn't help noticing conditions in the station yard. There were three coal cars and one box car on a siding, and unloading the three coal cars were two single-horse carts. At one of the cars they were actually screening the coal as they unloaded it. Now, right on the other side of those cars there was a coal shed. If that coal had been unloaded into the shed instead of into the carts, the cars might have been moved out on the road again to carry somebody else's coal. But no, they had to unload it, a car at a time, and to tie up three cars for about three times as long as was necessary. On that basis the service of two cars was lost for the entire time that the three cars were allowed to remain at Groton.

"If you multiply that sort of thing by the number of sidings in all the towns and villages of the country you will see what I mean by saying that the facilities provided by the railroads have overlapped the facilities provided by the shippers. Yet it is put up to the railroads to increase their facilities so as to eliminate the congestion. That is what we are trying to do, but you will not get any correct conception of the magnitude of the task until you consider just for a little while the problem of terminal facilities. That is where we have got to have the co-operation of the public more than anywhere else, for we have reached the limit of providing terminal facilities as the present development goes.

"The ability of the railroads to render service is absolutely dependent upon the matter of terminal facilities. And those are conditioned, not upon the length of the yards, but the number of tracks and the capacity of the cars. For instance, if you have 100 cars on a limited number of tracks and you want to pick out any 20 cars to move out somewhere, it is necessary, in practice, to move virtually the entire 100. But if you have the total amount of freight distributed among fewer cars of larger capacity, or have the 100 cars distributed over a greater number of tracks, there is a proportionate reduction of the number of cars that will have to be moved in order to pick out the 20.

"You come now against the flat limitations in this matter of terminal facilities. There is only a given amount of space available on all the island of Manhattan that you can cover with tracks, and we have practically reached the limit of carloads on the existing gage. Right here the question of motive power comes in. The freight car is like a bridge. The trucks are the piers and the body is the roadway. Now, in measure as you lengthen the body to take on more load, you have got to increase the dead weight of the car to be able to carry it, and every such increase in dead weight means a decrease in earning capacity for the car or for the train, when a given motive power is applied to move it. It is a matter of practical experience that if we could go on increasing the width of the cars up to a standard that would be permissible on a 6-ft. gage, or even a 5-ft. gage, we would be able to get a great deal more car capacity for a given increase in dead weight. Furthermore, we would gain in loading and unloading. If, for instance, by increased car capacity, you put into 20 cars freight which had previously taken up 30 cars, you require less terminal trackage for the handling of the freight, you are able to get it on and off with greater speed, and you have the other 10 cars out on the line earning something in the meantime.

"But right here we come up against the matter of motive power, and in that we have reached the limit of development under steam, so long as the present gage is employed. You will see why this is when you remember that there are three ways in which an engine can grow to get more tractive power. It must either be lengthened, be broadened, or be made higher. And in all three directions we have made our engines grow as far as they can on the present standard gage of 4 ft. 8 in. Did you ever ride in the cab of one of the modern freight locomotives. Well, you probably noticed the swaying back and forth that occompanied the drive of the pistons. That meant that the center of gravity had crept up just about as high as it could go without having the engine topple over when it got into action. It told you that we had gone as far as we could in building engines up into the air. Now, if you will think a minute you will see that there is obviously a limit in length of firebox beyond which it is impossible to fire an engine. And we have reached that limit as well. So there you are. If we increase our car capacity, we increase the unproductive dead weight that is to be drawn disproportionately to the increase of the load, and in so doing we are making demands upon tractive power that has already reached the limit of its development under present conditions. The obvious relief then would be by widening the gage to 6 ft., and I am not sure that the railroads will not come to that in the end. If the country after the civil war had adopted the 6-ft. gage that some of the railroads in the South then employed, or even a 5-ft. gage, we would be in much better shape to-day, for we could increase the height and breadth of our locomotives to get greater tractive power per engine, and could increase the capacity of our cars without disproportionately increasing the dead weight that has to be drawn in moving a given trainload. But perhaps it is chimerical to think now of rebuilding the railroads of the entire country and of replacing the entire railroad equipment. If so, what is the next best thing?

"Obviously electricity. And I believe that the railroads will have to come to that, not only to get a larger unit of motive power and of distributing it over the trainload, but on account of fuel. That brings up another phase of the existing conditions. We have to use up fuel to carry our fuel, and there are certain limitations here just as much as there are in car capacity or motive power, particularly when you consider the distribution of the coal producing regions with respect to the major avenues of traffic. The great

saving resulting from the use of electricity is apparent, quite aside from the matter of increasing the tractive power and the trainload, but there is this additional consideration, that when you are operating by electricity you are not losing money when you stop your train. That must not be lost sight of. The train makes money when it is going somewhere, when it is carrying something that somebody wants. When it stops it ceases to make money and becomes a losing proposition because it goes right on burning up coal without doing any work. Your electric train when it stops isn't using up any power, and the only fuel waste is that incidental to the maintenance of the system.

"I have gone into these things in detail to show you, first that the railroads in handling the increased volume of traffic under present conditions, or anything approximating them, must do it at an ever increasing ratio of expense that will tend some day to become prohibitive if present rates are to be maintained or fair returns realized for their shareholders, and, second, that the only relief which can be obtained through economies of physical operation must come through the outlay of enormous amounts of money such as would be involved in a general electrification or a change in gage.

"The railroads are new developing their facilities just as fast as conditions allow. The necessity of double-tracking the transcontinental lines is recognized universally, and we are all lengthening our sidings and our spur tracks in anticipation of the day when we can joint up the sections and have two-track roads across the country. But, do the best they will, the railroads are face to face with physical conditions, such as I have described, which make it impossible to handle a larger traffic without a constantly increasing ratio of expense. It is up to them and to the people whom they serve to devise some means of more economical operation if returns are to be continued to their shareholders, or rates even maintained on their present basis.

"But before we go on to that, there is one other factor of increased cost that the railroads cannot escape, whatever their economies, and that is the cost of labor, not only directly employed by them, but entering into every item of their new construction, their equipment, or their improved terminal facilities. It is a common saying that a railroad tie costs nothing; it is only the labor that the tie represents that costs money. The same thing might be said for the steel rail without stretching the truth, and relatively it is true of every article that goes into railroad construction or equipment. These increases are continuing ones and enter even into the very undertakings by which the railroads seek to obtain greater economies of operation. They have to be considered in the financing of railroad extension as well as in daily operation, and our economies, whatever they are, have got to be sufficient to offset them before we can figure on any actual reduction in the cost of handling the traffic.

"It is proper to consider here the general question of distribution of traffic during the year. We have been going on the basis of moving the great crops of the country in three or four months out of the twelve, with the expectation that the railroads will have ample equipment available for handling the cotton and the corn and the wheat from October, say, until the middle of January, and then will be able to employ all this equipment during the other eight or nine months of the year, so as to make it continuously productive. I don't suppose that idea will ever get entirely out of people's minds, but it is at least one important thing upon which there should be co-operation between the railroads and the shippers, if the roads are going to render the best service possible at the lowest rates, and have any care as well for the interests of their stockholders. You can find example in the coal troubles out on our lines, which would have been almost entirely eliminated if the users of coal had only allowed us to carry it for them in the summer when we have an opportunity to handle it expeditiously. But no, although we make substantial inducements to them to move their coal in the summer, they don't want to move it then. They want to wait until the busy season comes, and then want their coal in a hurry. You see there are two sides to that question."

Asked what specific enactment by the National government would help the railroads, Mr. Harriman's answer came quickly:

"Recognize by Federal statute the making of enforceable agreements between railroads for a distribution of traffic, and have such agreements binding for a given period of years."

"Would you have the enactment go far enough to permit pooling under proper supervision?" he was asked.

"No," he replied. "I don't believe in pooling. The railroads never accomplished anything by it when it was legal. If you will go back over the history of all the railroad pools that were ever attempted, you will find that there was always somebody who broke the agreement and made things worse than they were before, or else that when the railroads had arranged to pool the business at a certain point some outsider came along with a proposition to build a line in there, and wanted either a part of the business or a quid pro quo.

"The agreements that I have in mind would apply to the distribution of traffic so that it could be handled economically. As I have said in the last few days, the President started the movement for it on the part of the Government in his message last December, when he declared that railroads should be allowed to make agreements under certain conditions. I believe that he realizes the necessity for something of this kind, if the railroads are going to practice anything like the economies that the present situation demands, and it is right here that the railroads need the co-operation of the Government.

"Suppose we had such a law in operation and could arrange for the distribution of the transcontinental traffic between the various lines according to the possibilities of each, then the road with a low grade and small curvature could relieve the high-grade winding road of the excess of traffic that it could not carry profitably. Similarly, a distribution of classes of freight could be accomplished—which is absolutely impossible under present operating conditions—with resultant economies that are apparent when you consider what I have said.

"You can't make competition by law. The conditions which make certain points competitive or non-competitive are not to be fixed by statute. The thing that both the railroad and the shipper are anxious to get is the best possible service on the most economical basis, and it frequently happens that the very competition existing between various railroads in a given territory is wasteful and expensive. Take, for instance, the situation we had in Northern California, where both the Atchison and the Union Pacific were planning to build an important feeder line. By combining we are able to work harmoniously to develop that territory, whereas, if both lines had been built, each would have wasted facilities that might have been offered elsewhere to advantage."

The question was raised as to the effect of such agreements on the transcontinental traffic which is competitive, and the construction of the Western Pacific was mentioned as an example.

"If we had been allowed to make agreements with the Denver & Rio Grande and the Missouri Pacific," said Mr. Harriman, "the occasion for the construction of the Western Pacific wouldn't have arisen, and the traffic would have been better handled. We could have distributed it so that the Missouri Pacific and its allied lines would have got all they could handle profitably, and the remainder would have gone where it could be best taken care of.

"One thing that I think ought to be done is to allow the railroads to vary their freight schedules, so that the man who wants extra quick service, which can only be rendered at an increased operating cost, could be allowed to pay for it and get it, just as a man who wants to go to Chicago in 18 hours is allowed to pay for the extra service he receives, and does not have to take a 24-hour train just because there is only one rate.

"Of course, in all this there must be supervision by the Government. The railroads must recognize the necessity for that if they are going to get from the Government the relief they need."

The effect of agreements for distribution of traffic on railroad consolidations was the next question put to Mr. Harriman.

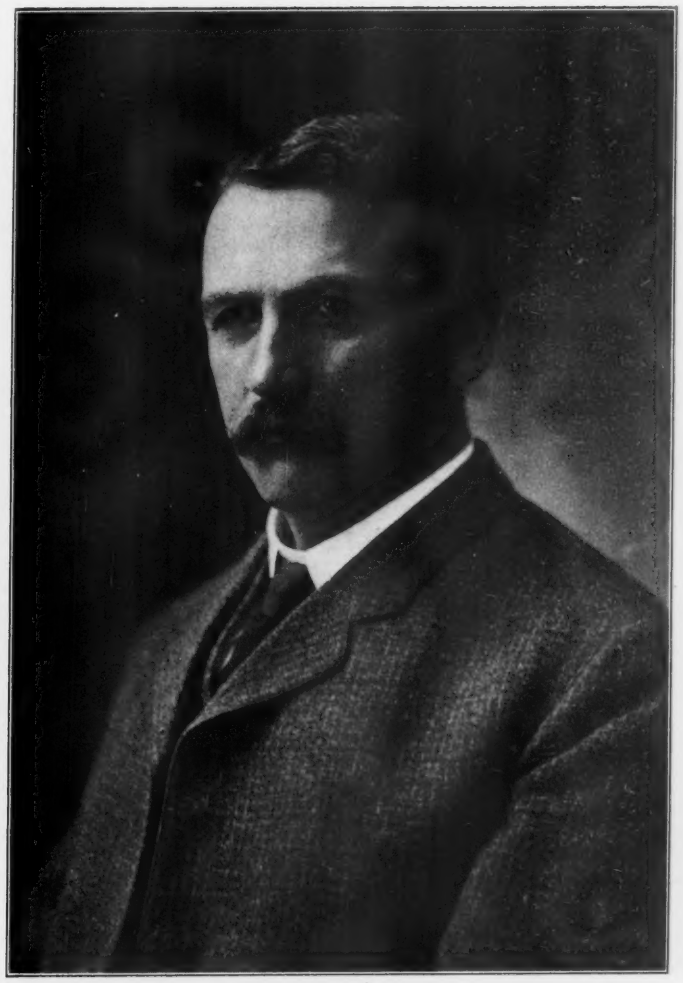
"It would stop them right away," he replied quickly. "I don't mind saying that if we could have made an advantageous agreement with the Central Pacific in 1901, whereby we could have developed that property and at the same time could have obtained the outlet that it afforded to the coast, the Union Pacific would never have acquired the Southern Pacific. It would never have been acquired if we could have made a permanent agreement, or one for a long term of years, whereby we could have developed the property and used it for an outlet.

"The same may be said of the Northern Pacific acquisition. We went into that because it appeared that the Burlington acquisition in the interest of the Northern Pacific and Great Northern was going to shut us out of important territory where we needed to be. We thought we had worked out a solution to the situation in the Northern Securities Co. whereby the rights of all parties would be conserved, but that couldn't be. Then came the redistribution of the stocks, which left the Union Pacific with a lot of Northern Pacific stock which the Supreme Court had said it couldn't keep. It was necessary for the Union Pacific to divest itself of this stock, and in the reinvestment of the proceeds of its Northern Pacific and Great Northern it looked to two things, first to secure a greater income return, and, second, to acquire holdings that would be beneficial to the road. So it turned to connecting lines and lines where its influence would operate to bring it business. I mention this because it shows the way in which the Union Pacific's position has developed by virtue, primarily, of the fact that it was unable in 1901 to make such agreements with other railroads as would have enabled it and them to reap a mutual advantage by an economical division of traffic."

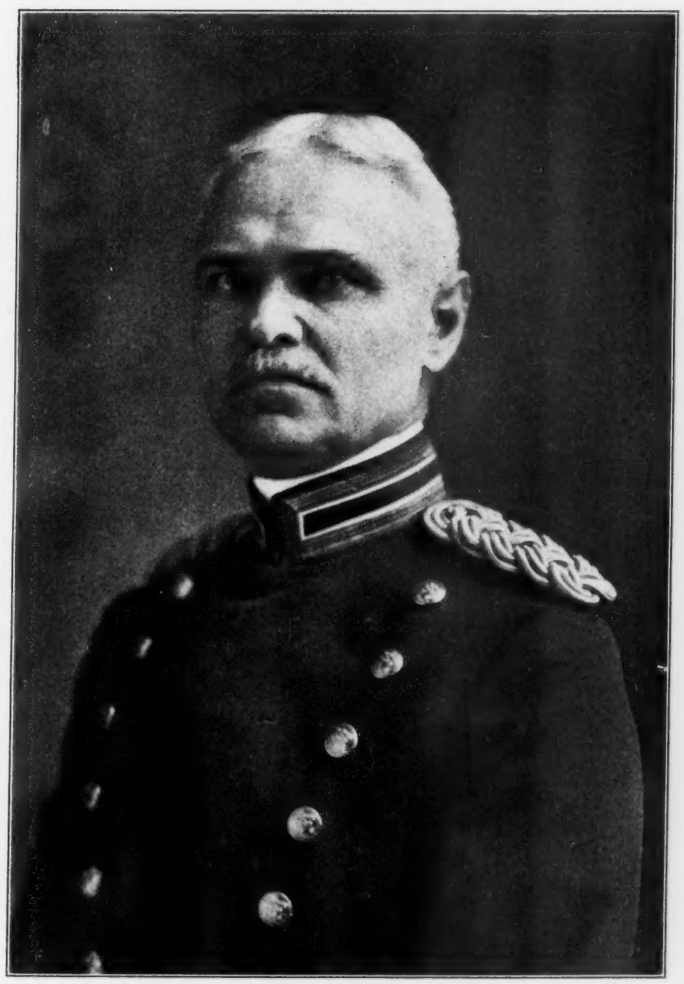
Pacific Locomotive for National of Mexico.

In the description of the details of the Pacific locomotive for the National Railroad of Mexico published on March 1, it was stated that the connecting rod was a steel casting. This was an error, as the rods are made of forged steel of 80,000 lbs. tensile strength.

Colonel W. C. Gorgas.



John F. Stevens.



Lieutenant Colonel G. W. Goethals.
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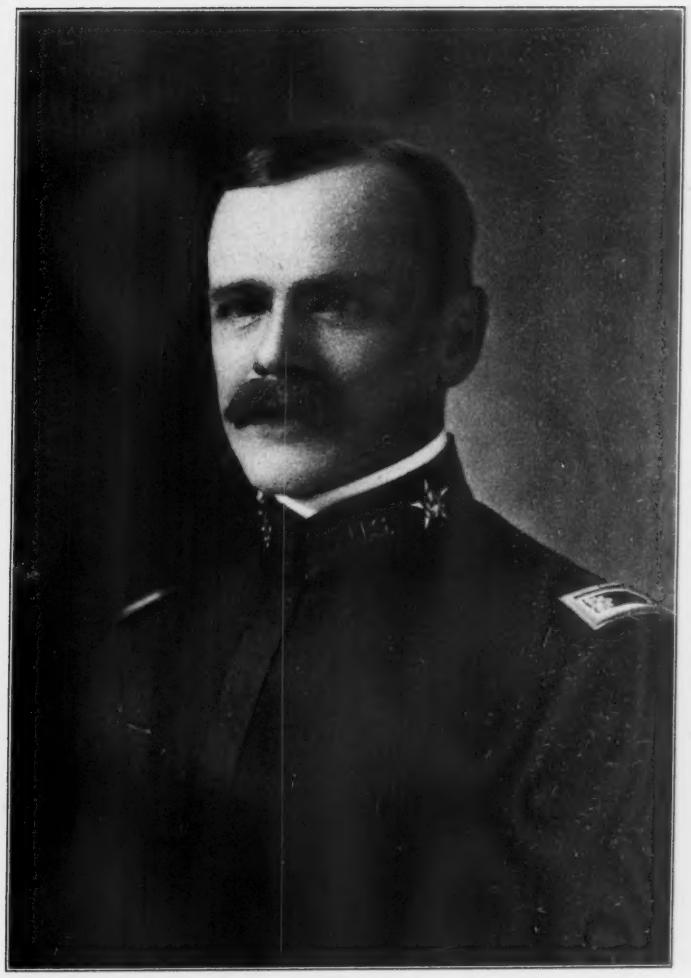

Major D. DuB. Gaillard.
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Four Members of the Isthmian Canal Commission.

Comparative Effects of Steam and Electric Locomotives on a 3-deg. Curve.

The following calculations of the stresses developed in curved track by steam and electric locomotives were made by the engineers of the New York Central following the derailment of an electric train on a 3 deg. 5 min. curve near Woodlawn on the Harlem Division on February 16, 1907. The track at this point has a superelevation of 4½ in. and a gage of 4 ft. 8¾ in. The wheel spacing and loads of the two types of locomotives considered are shown on the accompanying diagrams.

There are three fundamentals of "mechanics of curve resistance":

(1) Component of slipping in the direction of the radius, due to curvature.

(2) Component of slipping in the direction of the tangent of track, due to unequal rail lengths inside and outside.

(3) Net effect of centrifugal force (superelevation of outer rail considered).

The locomotive in rounding a curve must be revolved against these forces, Nos. 1 and 2, and such a pressure applied as will cause the locomotive to follow the curve. The point about which the locomotive revolves may be determined mathematically and the stresses resulting from these two effects can be determined by calculation. Due consideration should be given to the action of the rigid wheel base on the curve in question, taking into account the clearance in the gage and the clearance between the main drivers and the rigid frame.

The radial slip on the front outside driver when rounding the curve is self-contained and of itself does not tend to displace the rail; the radial slip on the inside front driver does tend to displace the outer rail acting through the front axle to the outer front driver.

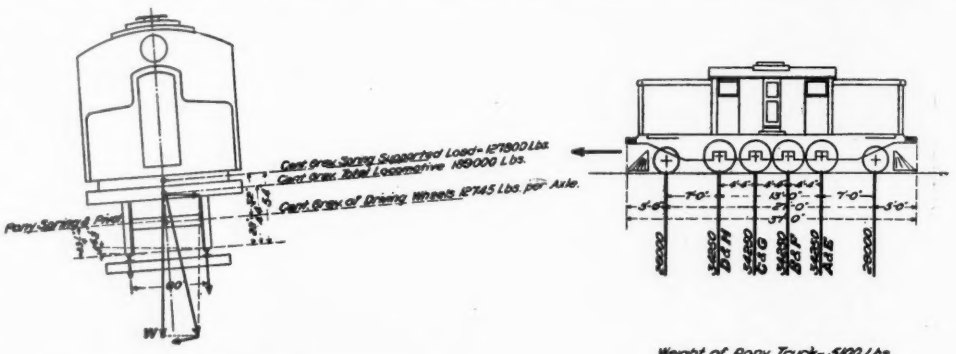
If the clearance between the driving wheel hubs and the locomotive frame is more than the departure of the curve at the second axle, the second axle will run to the outer rail until the flange of the outer second driver bears against the rail and thus the frame of the locomotive does not have to carry the stresses necessary to produce radial slippage of the second set of wheels.

The centrifugal effect and superelevation of the outer rail are readily calculated and need no explanation.

Considering first, the condition where the second driving axle bears against the locomotive frame and so transmits the radial thrust of the second axle to the outer front driver, a comparison of the New York Central electric locomotive with the Atlantic type steam locomotive on a three-degree curve with a 4½-in. superelevation shows that the pressure of the steam locomotive driver against the rail is greater at all corresponding speeds. The resultant shear on the spikes, however, allowing for the friction of the rail on the tie plate, is less with the steam locomotive than with the electric locomotive up to about 60 miles an hour.

The difference between the pressure against the rail and the shear on the spikes is affected, so far as the drivers are concerned, by the height of the center of gravity under the influence of centrifugal force increasing the vertical pressure on the outer rail. The greater effect for the higher center of gravity of the steam locomotive disappears, however, at the higher speeds by reason of the increasing preponderance of the horizontal force due to centrifugal action.

At about 90 miles an hour the shear on the spikes for the steam locomotive would be approximately the same as that of the electric locomotive, but at this speed the steam locomotive would be in danger of overturning.



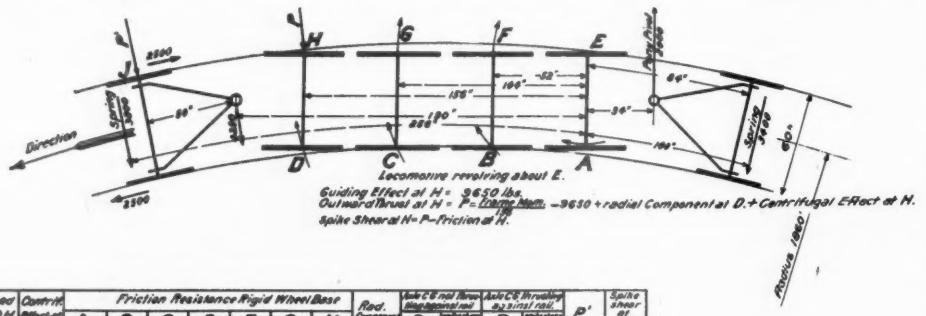
Speed M.P.H.	Weights on Rigid Wheel Base						
	A	B	C	D	F	G	H
40	14525	20570	18500	17300	13785	15745	18750
50	13775	19975	17100	15800	14275	17140	17450
60	13125	18300	15945	13645	14245	18300	18605
70	12425	18500	14900	14300	15745	19355	19950
80	11425	17800	13770	12770	18630	20470	21480

Fig. 1—Wheel Loads Under Electric Locomotives.

The maximum shear on the spikes is not necessarily caused, however, by the driving wheels of the locomotives, but at certain speeds may exist at the leading wheel of the guiding truck. Although the pressure of the guiding truck wheel against the rail may be actually less than that of the driver, the weight upon the rail of the guiding wheel is so much less that the resultant shear on the spikes is consequently greater. On the electric locomotive the shear on the spikes, due to the guiding truck, is in excess of that due to the drivers up to about 40 miles an hour. On the steam locomotive the shear on the spikes due to the guiding truck is in excess of that due to the drivers up to about 65 miles an hour, and this shear exceeds that of either the driving or truck wheel of the electric locomotive up to about 57 miles per hour.

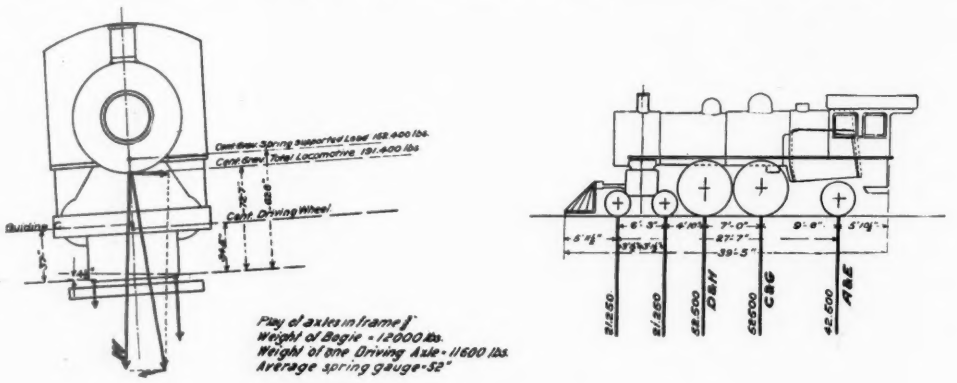
Considering second the condition where the second driving axle clears the locomotive frame by reason of the end play and so bears directly against the outer rail without transmitting to the leading driver the thrust due to its radial slip.

The pressure against the rail of the leading steam locomotive driver as before is greater at all corresponding speeds. The resultant shear on the spikes is less, however, with the steam locomo-



Speed M.P.H.	Centrif. Effect at F	Friction Resistance Rigid Wheel Base A	B	C	D	F	G	H	Rad. Component at F	Axle C.G. and Throw Horizontal rail P	Axle C.G. thrusting against rail at H	Axle C.G. thrusting against rail at H	P'	Spike shear at J
40	-1590	3600	5150	4620	4380	3440	3920	4180	4080	4740	560	3860	—	6410	2410
60	1320	3450	4980	4300	4200	3560	4280	4360	3930	7400	3040	4120	—	6600	2570
60	4880	3300	4800	3980	3900	3740	4560	4650	3640	10470	5820	4480	—	6830	2780
70	9050	3130	4620	3720	3580	3940	4830	5000	3350	14130	9130	7460	2460	7100	3080
80	13790	2900	4400	3430	3200	4150	5100	5360	2970	18360	13000	11000	5640	7400	3390

Fig. 2—Diagram of Track Stresses Under Electric Locomotive.



Speed in M.P.H.	Weights on Rigid Wheel Base. A	C	D	G	H
40	22120	27085	27085	25165	25145
50	20540	25365	25365	24685	26885
60	18590	23245	19545	29006	32705
70	16590	21055	14555	31195	37695
80	13640	17945	7245	34305	45006

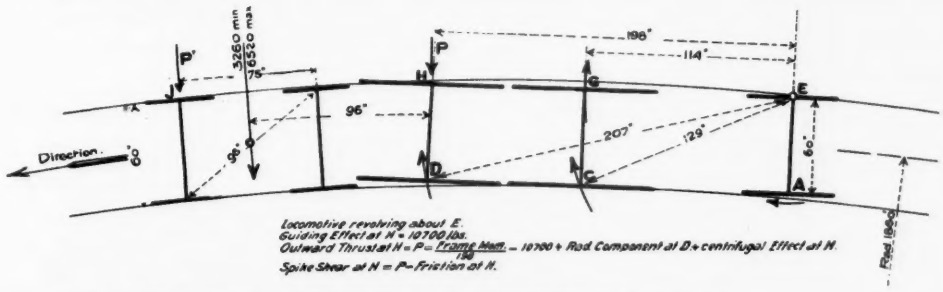
Fig. 3—Wheel Loads Under Atlantic Type Steam Locomotives.

tive due to the effect of its higher center of gravity. Under this second condition with the electric locomotive the shear on the spikes due to the guiding truck is in excess of that due to the drivers up to about 75 miles an hour. On the steam locomotive the shear on the spikes due to the guiding truck is in excess of that due to the drivers at all speeds and this shear exceeds that of either the driving or truck wheels of the electric locomotive up to 75 miles an hour.

Regarding the stress on the outer spikes of the outside rail, it will be seen from the tables accompanying the diagrams that for a speed of, say 60 miles an hour, on a 3-deg. curve with a superelevation of 4½ in., the maximum shear on the spikes with the forward driver only bearing against the outer rail, is 5,820 lbs. as compared with 4,890 lbs. for the steam locomotive, or a difference of about 19 per cent.; but on the other hand, if the comparison is made on the basis of the two forward drivers bearing against the outer rail of the electric locomotive, the unbalanced pressure is 2,780 lbs., as compared with 4,890 lbs. on the steam locomotive, a difference in favor of the electric locomotive of 43 per cent.

The ultimate shearing resistance of the standard spikes used on the curve in question ranges from 14,440 pounds to 17,060 pounds. Assuming a factor of safety of 4, the permissible shear per spike is 3,810 pounds to 4,265 pounds.

The 100-pound rail in use on the curve acts as a continuous girder distributing the stresses over several spikes, but to be conservative, two spikes may be taken as resisting the unbalanced outward thrust. Consequently at 60 miles per hour we have actual maximum shears with either steam or electric locomotives ranging from 2,780 pounds to 5,820 pounds borne by two spikes, which with a factor of safety of 4, are proper for shears of 7,620 pounds to 8,530 pounds. In other words, the actual factor of safety is approximately 6.



Speed M.P.H	Cent. Effect at H.	Friction Resistance Rigid Wheel Base. A	C	D	G	H	Rod Comp. at D	Axle & Coupling Bearing Shear P	Spike Shear at H	Axle & Coupling Bearing Shear P	Spike Shear at H	P'	Spike Shear at J
40	-380	5530	6770	6770	6280	6280	6280	6120	——	6260	——	7830	4630
50	1970	5130	6340	6340	6720	6720	6080	7450	730	6220	——	7950	4740
60	7450	4650	5810	4890	7250	8170	4680	11230	3060	5460	——	8130	4690
70	13090	4150	5250	3640	7800	9420	3500	15390	5970	7570	——	8170	4840
80	21050	3410	4490	1810	8580	11250	1730	21160	9910	13020	1820	8200	4770

Fig. 4—Diagram of Track Stresses Under Atlantic Type Steam Locomotives.

In conclusion, it appears that on the basis of the forward driver only bearing against the outer rail, the electric locomotive imposes slightly greater unbalanced stresses than the steam locomotive, whereas, on the basis of the two forward drivers bearing against the outer rail, the steam locomotive imposes considerably greater unbalanced stresses. Therefore the shearing force on spikes, one on the outside of the outer rail in each tie, with tie plates, is far within the limits of safety for speeds in excess of the so-called "equilibrium speed" of 46½ miles per hour to which the superelevation of 4½ in. corresponds.

As proof of this contention the results of many experimental runs made on the six mile test track west of Schenectady can be cited.

The electric locomotive was purposely driven at speeds of 75 miles an hour around a curve that was elevated for but 60 miles an hour, so as to bring out any tendency that might exist with the locomotive to spread the gage. This high speed developed a centrifugal force sufficient to move the ties in the gravel ballast, but there was no widening of the gage under such extreme conditions, thus demonstrating that even such excessive speeds around insufficiently elevated curves, producing a centrifugal force sufficiently great to shift the track in the ballast and distort the curvature, would still not cause a widening of the gage on this inferior track. In other words, it was demonstrated that the method of spiking curves in ordinary practice was sufficient to meet even abnormal conditions.

Electric Night at the New York Railroad Club.

The meeting of the New York Railroad Club on March 15 was held in its new quarters at the Engineering Society's building. A general discussion of heavy electric traction which resolved itself in the beginning into a defense of the New York Central's electric locomotives was participated in by a number of prominent engineers and railroad officers.

Mr. W. J. Wilgus, Vice-President of the New York Central, undertook to defend the electric commission, of which he was the chairman, against the attacks which had been made from various sources on the safety of the electric locomotives and other features of the New York Central electrification scheme. He briefly reviewed the exhaustive tests which were made on the experimental tracks west of Schenectady in the precautions taken in instructing enginemen and thoroughly trying out the new locomotives and motor cars for a number of months between High Bridge and King's Bridge before they were put into actual service. He pointed out that during the searching investigations by the railroad company and by the coroner's jury nothing had developed which showed that the electric installation was in any way responsible for the derailment at Williamsbridge. The current in the third rail was automatically cut off almost instantly after the accident happened, and none of the passengers, or those who came to their relief, were injured by coming in contact with it.

Mr. Frank J. Sprague reviewed the preliminary work of the electrical commission of which he was a member and read a somewhat lengthy comparative description of the electrical locomotives as finally approved and built and other designs of locomotives submitted at the time bids were asked for. The type finally adopted was unanimously considered the most suitable for the work to be done. He reviewed the circumstances leading up to the wreck and the conditions obtaining at the time so far as they have been definitely brought out in the inquiries made by the State Railroad Commission and the coroner's jury. The testimony brought out no single fact which would lead to a definite conclusion that the electric locomotives were themselves responsible for the derailment or that the casualties resulting therefrom were greater than if a similar accident had occurred where electricity was not in use. He read a list of 12 derailments due to broken rails or other causes which had occurred within a period of approximately two weeks, and pointed out the injustice of coupling the wreck on the New York Central with the electric system as a cause.

Mr. George Gibbs, Chief Engineer of Electric Traction on the Pennsylvania, New York & Long Island, discussed the problem of heavy electric traction in a general way. He uttered a word of caution regarding many of the published estimates of the cost of installing electric traction on a steam railroad. His experience led him to believe that under average conditions the cost of electric

TABLE OF COMPARATIVE SHEAR ON SPIKES AT LEADING TRUCK WHEEL AND AT DRIVER WHEELS FOR ELECTRIC LOCOMOTIVES AND CENTRAL-ATLANTIC TYPE STEAM LOCOMOTIVES, ON THREE-DEGREE CURVE, SUPER-ELEVATION, 4½ INS.

	Rail thrust leading truck wheel.	Friction bet. rail and tie plate leading truck wheel.	Shear on spikes by leading truck wheel.	Rail thrust leading driver		Friction bet. rail and tie plate leading driver.	Shear on spikes by leading driver	
				2d driver not against rail.	2d driver against rail.		2d driver not against rail.	2d driver against rail.
			Electric locomotive.					
40 miles per hour.....	6,410	4,000	2,410	4,740	3,860	4,180	560	.....
50 " " "	6,600	4,030	2,570	7,400	4,120	4,360	3,040	.....
60 " " "	6,830	4,050	2,780	10,470	4,480	4,650	5,820	.....
70 " " "	7,100	4,080	3,020	14,130	7,460	5,000	9,130	2,460
80 " " "	7,400	4,100	3,300	18,360	11,000	5,360	13,000	5,640
			Steam locomotive (Atlantic).					
40 miles per hour.....	7,830	3,200	4,630	6,120	6,260	6,280	.....	.....
50 " " "	7,950	3,210	4,740	7,450	6,220	6,720	730	.....
60 " " "	8,130	3,240	4,890	11,230	5,460	8,170	3,060	.....
70 " " "	8,170	3,330	4,840	15,390	7,570	9,420	5,970	.....
80 " " "	8,200	3,430	4,770	21,160	13,020	11,250	9,910	1,820

NOTE.—Figures underlined represent maximum shear by either leading truck wheel or driving wheel under worst possible conditions.

equipment was only about one-half of the total cost involved. For average trunk line work he did not believe that electric operation, in the present state of the art, could be made to effect enough saving in operating expenses to offset the additional capital charges. In large terminals where reduction of switching will increase capacity, where safety and cleanliness in tunnels and cities are controlling features and for heavy mountain grade operation, where cheap fuel or water power can be utilized, he thought electrification might well be introduced, not to save money but to make money. He did not believe that the steam locomotive was doomed for many years to come. He also had a word of warning regarding excessive speeds which are the aim of promoters of every electric road. The high average speed of electric traction is made possible by equipping each car with motors or by putting an excess of power at the head of the train. This excess of power enables rapid acceleration, and where numerous stops are made, an appreciable shortening of the running time can be secured. It is possible, however, to carry the matter of high speed too far, that is, to a point where unless safety is sacrificed the trains are required to be kept such great distances apart that the capacity of the line is greatly reduced.

Mr. W. B. Potter, Chief Engineer of the Railway Department of the General Electric Company, reiterated the statements of Mr. Wilgus and Mr. Sprague regarding the thoroughness of the tests made on the New York Central locomotives before they were put in operation. Referring to the question of high speed on electric roads he said that he had been interested in investigating a proposition to operate an electric road at schedule speeds of 200 miles an hour. He had made some comparisons regarding the number of passengers that could be carried between two points at that rate of speed and he came to the conclusion that the greatest number of passengers that could be carried between two points could be handled better on a moving sidewalk. With such enormously high speeds the headway between trains, necessary for safety, becomes so great that there is no gain in carrying capacity but rather a loss. He felt, however, that speeds of up to 100 miles an hour were quite possible in the future.

Mr. S. M. Vauclain, of the Baldwin Locomotive Works, was the next speaker. He referred to his long experience in building steam locomotives, and said that he thought we were going ahead a little faster than we ought to in building electric locomotives. Steam locomotive designers have learned along what lines to build the running gear for maximum safety and efficiency. He felt that if the designers of electric locomotives would follow the fundamental principles that underlie the construction of high speed steam locomotives there would be no difficulty in operating electric locomotives at speeds up to 100 miles an hour. But electric motors have not yet been built which have enough power to maintain that speed. High speed steam locomotives have the driving wheels proportioned to the speed desired, roughly 1 in. diameter for each mile per hour speed. This does away with high rotating speeds and increases the height of the center of gravity. Increasing the height of the center of gravity greatly decreases the destructive effect of a locomotive by nosing when running at high speed. Another feature which assists in relieving the track of severe stresses is the fact that by far the greater part of the weight of a steam locomotive is supported on springs and is free to roll independently of the driving wheels. In the present designs of electric locomotives the axles of the driving wheels carry a large dead load without the interposition of springs. His experience led him to believe that the successful electric locomotive of the future would be built with the motors set on the frames and connected with the driving wheels by a system of driving rods substantially the same as are now used on steam locomotives. The reason this has not been done is because the manufacturers of the electric apparatus have so far been unable to produce motors sufficiently powerful and compact to mount on the frames, but instead have followed the early practice in street car work and have confined themselves to efforts in the direction of building motors directly geared or mounted on the driving axles.

Foreign Railroad Notes.

According to consular reports, there were in Brazil on January 1, 1906, 10,427 miles of railroad, an average of one mile of railroad for each 313 square miles of country.

On the Victorian Railroads foot warmers have been provided for the cars in use on many of the country trains, thus adding to the comfort of passengers, especially those traveling during the winter on trains starting in the early morning.

Through mail service, but for letters and postal cards only, from Western Europe to Eastern Asia (by way of Vladivostok), which was suspended by the Japanese war, was resumed only last February. The time from Moscow to Vladivostok is 12 days and 7 hours; from Berlin to Vladivostok, 14 days.

Track Deformations and Their Prevention.*†

II.

BY G. CUENOT,
Chief Engineer of Bridges and Ways for the Board of Control of the Paris, Lyons & Mediterranean Railway.

PRINCIPAL MOVEMENTS TO WHICH THE TRACK IS SUBJECTED.

The tracks, made as has been explained, have permitted the study of the principal movements to which they are subjected, and which cause their deformations; they are produced in a longitudinal direction, in the direction of the travel of the trains, and in the transverse direction.

It is important to analyze them with care, in order to seek the means for remedying them.

LONGITUDINAL MOVEMENT.

The weight on the wheel is distributed over a certain number of cross ties, and imposes on them a vertical movement, directed at first from low to high, then from high to low, when the load is brought near.

Mr. Coüard has recorded these facts by means of the apparatus of Marey, and has derived from the experiments which he performed in June, 1903, between Melun and Bois-le-Roi, the following conclusions:

When the first wheel of the engine is at 6 meters (19.68 ft.), the movement of the cross tie, from low to high, begins.

When the first wheel of the engine is at 3 meters (9.84 ft.), the displacement is maximum.

When the first wheel of the engine is at 2 meters (6.56 ft.), the movement from high to low below the initial position begins.

When the wheel is on the cross tie the depression of the tie reaches its maximum.

But these figures are only averages, and the mean distance of 2 meters (6.56 ft.), from which place the depression of the cross tie in the ballast commences, goes on increasing from the advance to the following end. It follows that the bending rail in its first half, over shorter length, ought to curve more in that part.

Mr. Ast, Director of Ways and Cross Ties (Austria-Hungary), by the use of instantaneous photography has confirmed the results and shown, afterwards, that the ballast was compressible and underwent movements analogous to those of the cross tie, although less.

It was our desire to verify the results given by those engineers,

Fig. 1.

Fig. 2.

and to observe the influence of more rigid cross ties on the vertical movement. We had at our disposal, aside from the wood cross ties in use on the Paris, Lyons & Mediterranean System, the composite cross ties laid as described in one of the main tracks of the line from Mouchard to Bourg. The experiment was made by an engine with three axles coupled weighing 32 tonnes (35.27 net tons) in working order, a tender of 24 tonnes (26.46 net tons), and a car.

This train was moved on a bay provided with ordinary wood cross ties, then on another bay with composite cross ties, each of these bays being comprised between two successive joints. The wood cross ties supported P. L. M.-A. rails, the composite cross ties P. M. rails, having a greater weight and rigidity.

The first axle of the engine was brought as near as possible to the cross tie to be tested. There were marked off, by a special rule and a gage, of which a description will be given further along, when we study the flexure, points on the rail at each cross tie; these same points were retaken at each stoppage of the train, that is to say, each time it advanced a length corresponding to the spacing of the cross ties. The points thus marked off on each rail were joined, for each position of the train, by a full line where it refers to the movement on the track composed of ordinary cross ties, and by a dotted line where it refers to the track with composite cross ties. Each of these lines, represented on Plates 4 and 5, give the undulatory movement of the track in each of the positions of the train, when the latter is stopped successively right at each of the cross ties. This movement is quite like that which has been described by Mr. Coüard; when the first wheel of the engine is found at a certain distance (about 6 m.) (19.68 ft.) from a cross tie, the movement from low to high commences; the latter is maximum at 3 meters (9.84 ft.), then it reverses and the cross tie sinks, the maximum corresponding with the passage of the first axle.

The part of the track, in which the composite cross ties were placed, was much worse, as has been explained above, than that where the ordinary cross ties were located. The roadbed was less hard and above all the ballast was more moist, more muddy; the consequence of this was that the composite cross ties were not

†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines, Southwest System.

perhaps buried more at certain points than the wood cross ties placed under more favorable conditions; but, as a whole, the profile with composite cross ties is much less accentuated than that with wood cross ties. The rise is much less marked, that is to say, the track as a whole being more rigid, the oscillatory movement is diminished. The ramps, which the train has to surmount, are less, that is to say, the traction is better and exerts a smaller effort. The joint which is induced from low to high, by the oscillatory movement of the track, and which by this fact is disorganized, as will be seen further along, is not so to speak more affected, when the track is provided with composite cross ties.

The table herewith exhibits the results:

Designation of position first axle of engine.	Ascents to overcome: Ordinary cross ties: 10ths of millim.	Ascents to overcome: Ordinary cross ties: 100ths of an inch.	Ascents to overcome: Composite cross ties: 10ths of millim.	Ascents to overcome: Composite cross ties: 100ths of an inch.	Movement of the joint: Ordinary cross ties.	Movement of the joint: Composite cross ties.
1	16	6	17	7	1	0
2	18	7	17	7	0	4
3	26	10	20	8	2	4
4	33	13	25	10	1	2
5	43	17	17	7	3	1
6	34	14	14	5	2	0
7	23	9	11	4	2	0
8	17	7	10	4	4	1
9	14	5	17	7	2	3
10	11	4	16	6	0	4
11	6	2	14	5	16	9
12	8	3	6	2	11	11
13	15	6	20	8	0	1
14	16	6	20	8	2	3
15	18	7	19	8	2	2
16	23	9	14	5	3	0
17	23	9	11	4	6	0
18	27	11	8	3	5	0
19	24	10	14	5	6	0
20	14	5	11	4	6	1
21	13	5	7	3	5	1
22	14	5	14	5	6	3
23	1	..	15	6	8	3
24	8	3	7	3	18	13
Total.....	445	..	324	..	106	65
Mean.....	$\frac{445}{24}=18$	7	$\frac{324}{24}=13$	5	$\frac{106}{24}=4.4$	$\frac{65}{24}=2.7$

NOTE.—The positions from 1 to 12 correspond to the track on the long radius; those from 13 to 24 to the track on the short radius.

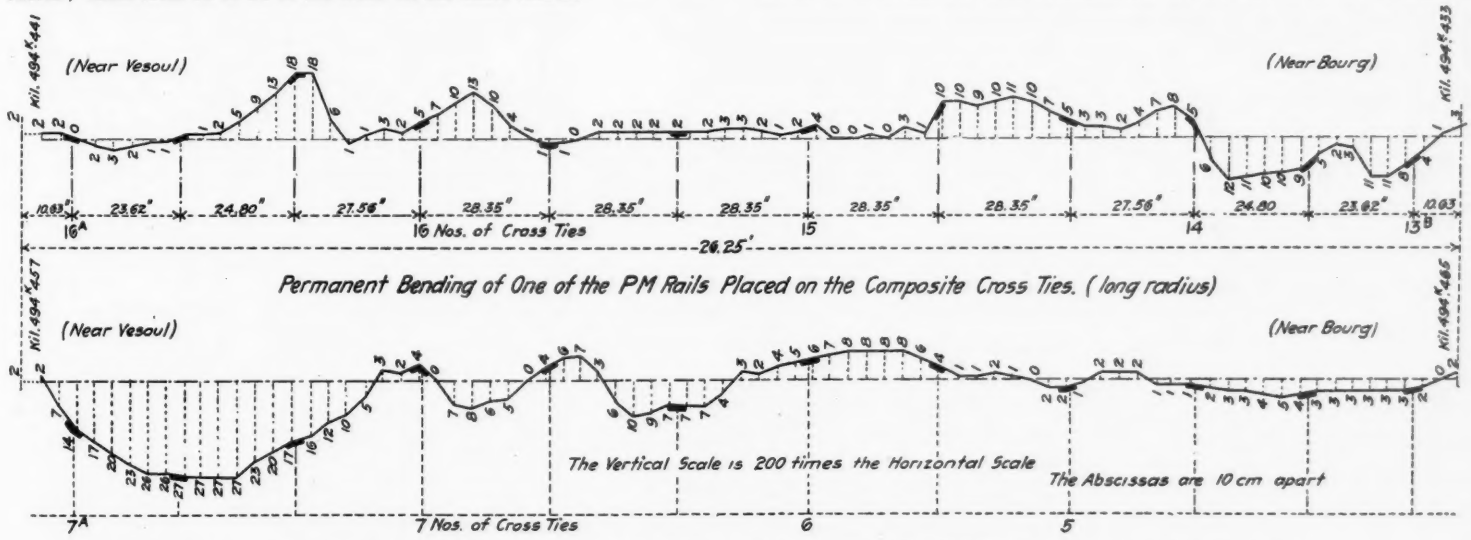


Fig. 3—Permanent Bending of the Two Types of Rails on Long Radius Ties.

In recapitulation, the use of rigid cross ties has diminished the effort of traction in the proportion 13 to 18, that is to say, that the tractive effort on rigid ties is about 30 per cent. less than on the ordinary cross ties. The movement of the joint is reduced by about one-half. The result was indeed what one could expect. It demonstrates the importance of the longitudinal movement, and the advantage of diminishing it by using rigid tracks.

It can be objected that the comparison made is not perhaps entirely exact, since the P. L. M.-A. track, laid with ordinary cross ties, is less rigid than the P. M. track with composite cross ties, and that everything in the case in hand was combined to obtain a more favorable result. That objection ought to be dismissed, for the influence of the subsoil and of the ballast counterbalanced, and more, the rigidity of the rail.

TRANSVERSE MOVEMENT.

The transverse movement of the track is of still greater importance than the longitudinal movement, and produces more important effects. It arises from this that the cross tie is not only buried in the ballast, but it bends; each of its points seems then to be buried in the ballast by unequal quantities, and this unequal sinking results in the greatest deformations of the track.

Mr. Coüard has studied the question with all desirable care, but his measuring instruments, doubtless imperfect, have not permitted him to draw from his study all the conclusions which should have been derived. The form of the curve of deformation which he has found (*Revue des Chemins de Fer*, July, 1897,) is such that it does not permit the deduction of a general law from the phenomena observed. However, that engineer has found that the vertical displacements of cross ties hardly reach 3 millimeters (⅛ in.), and that they are not proportional to the weights supported. He has concluded from it "that the cross ties fixed to the rail remain, at certain points, suspended above the ballast, and that right at the rail there is formed, under even the best tamped cross ties, some depressions of ballast on the edges of which the cross tie is supported; that under the passage of a wheel even lightly loaded, the cross ties come in contact with the ballast and deflect to the depth of the depressions; that from this moment only the importance of the bending is proportional to the load." Basing their study on the theoretical researches of Winckler, some notable engineers, Shwedler, Hoffmann, Lehwald, Riese and Zimmermann, have studied the manner in which cross ties behave when resting on an elastic foundation. They have determined the deformations which they experienced under the effect of a load in repose, and estimated the magnitude of the tensions of flexure which result from it.

If the cross ties were completely rigid there would result a uniform distribution of the pressure on the ballast. But it is not so; the cross tie is unequally buried in the ballast, in such a way that the pressure is no longer uniform, but is greater right at the rails.

The cross tie should, then, be considered as a continuous beam resting on an elastic base unsolved for continuity, and supporting a vertical load at two points. The German engineers designate by *load on rail* the pressure which the rail exercises on the cross tie, and that pressure depends as much on the transverse section of the rail as on that of the cross ties, as well as on their spacing and on their bedding. They admit, also, that the deformations and the strains experienced by the cross tie vary with the length and nature of the tamped bed.

Starting from these premises, they have found that the elastic curve of a cross tie was represented by Figure 1 or by Figure 2, according as the cross tie was 2 m 40 (7 ft. 10.4 in.) or 2 m 70 (8 ft. 10.3 in.) long.

The cross tie of 2 m 40 (7 ft. 10.4 in.) would be deformed then according to a convex curve; the maximum of the sinking would be produced at the extremities and would continue diminishing toward the middle. But, with a cross tie 2 m 70 (8 ft. 10.3 in.) long, the maximum sinking would be produced nearly under the rail, and the permanent compression of the ballast would be diminished from this point nearly uniformly on both sides, in such a way that even a deeper sinking would not have as a consequence a change in the inclination of the rails, nor in the spreading of the track.

The theory assumes an absolutely homogeneous cross tie with a tamped bed continuous and uniform over its entire length. The German engineers think indeed that this hypothesis is not realized in practice; they recognize also that short cross ties present in reality a curve of deformation similar to that of long cross ties; but they explain this difference between theory and practice by the stronger tamping of the heads of the cross ties.

The incomplete results given by Mr. Coüard, the very ingenious theory of the German engineers, rendered necessary the study of the deformation of a cross tie under a load, of the manner in which the ballast behaves under the cross tie, of its more or less

extent of compressibility, of its more or less extent of elasticity. The experiments which have been carried on during nearly two years have had this object as their principal end.

CURVES OF DEFORMATION OF CROSS TIES.

They have taken place under the most different conditions of temperature and humidity, in such a way as to have the terms of comparison numerous, to be able to compare them and to determine an aggregation of facts which may not be controvertible. They have been carried on at three different periods; from the 4th to the 15th of May, during a rainy period, after a prolonged season of rain; from the 19th to the 30th of June, after a drier season, and finally at the end of the month of July, 1903, at a time when the rains had just returned. (I do not give an account of the last experiments, which only confirm the results of those which are given.) In all the tests the ballast, composed as has been pointed out above of rough gravel agglomerated with argillaceous sand, was particularly moist, and consequently muddy. This state of moisture was so great that it was maintained even in the period of heat in the months of June and July. The drying of the ballast was not completed, by reason of the position on a curve, and of the inclination toward the interior of the track, which is the consequence of it (0 m 083) ($3''/_{32}$ in.), the loads were carried on the rail on the side of the short radius. The ballast was therefore more compressed on that side than on the other; its permanent sinking was consequently more pronounced, and it preserved, after the passage of vehicles, the form of a plane slightly inclined toward the center of the curve. The cross tie rested thus toward the extremity of the inclined plane on the side of the long radius; the water accumulated in the lowest part of this inclined plane, that is to say on the side of the short radius. The ballast was therefore particularly wet on that side; it was possible, by making a trench right at the cross ties, to let the water flow off, which rendered the support very elastic. The drop of the vehicles from the advance-rail to the following-rail rendered this effect still more sensible right at the cross ties of the following end of the even-joint; the hammering of the ballast by the shocks of the wheels augmented the depression between the bottom of the cross tie and the upper part of the support, a depression in which the water accumulated. Also, at the passage of vehicles, the water was projected vertically; the cross tie and the rail bore traces of these ejections. This fact was not isolated and peculiar to the part of the track which we studied. Wherever the ballast is but little permeable, and can form a cake more or less firm, the same phenomenon is observed, which shows above all right at the cross ties of the even-

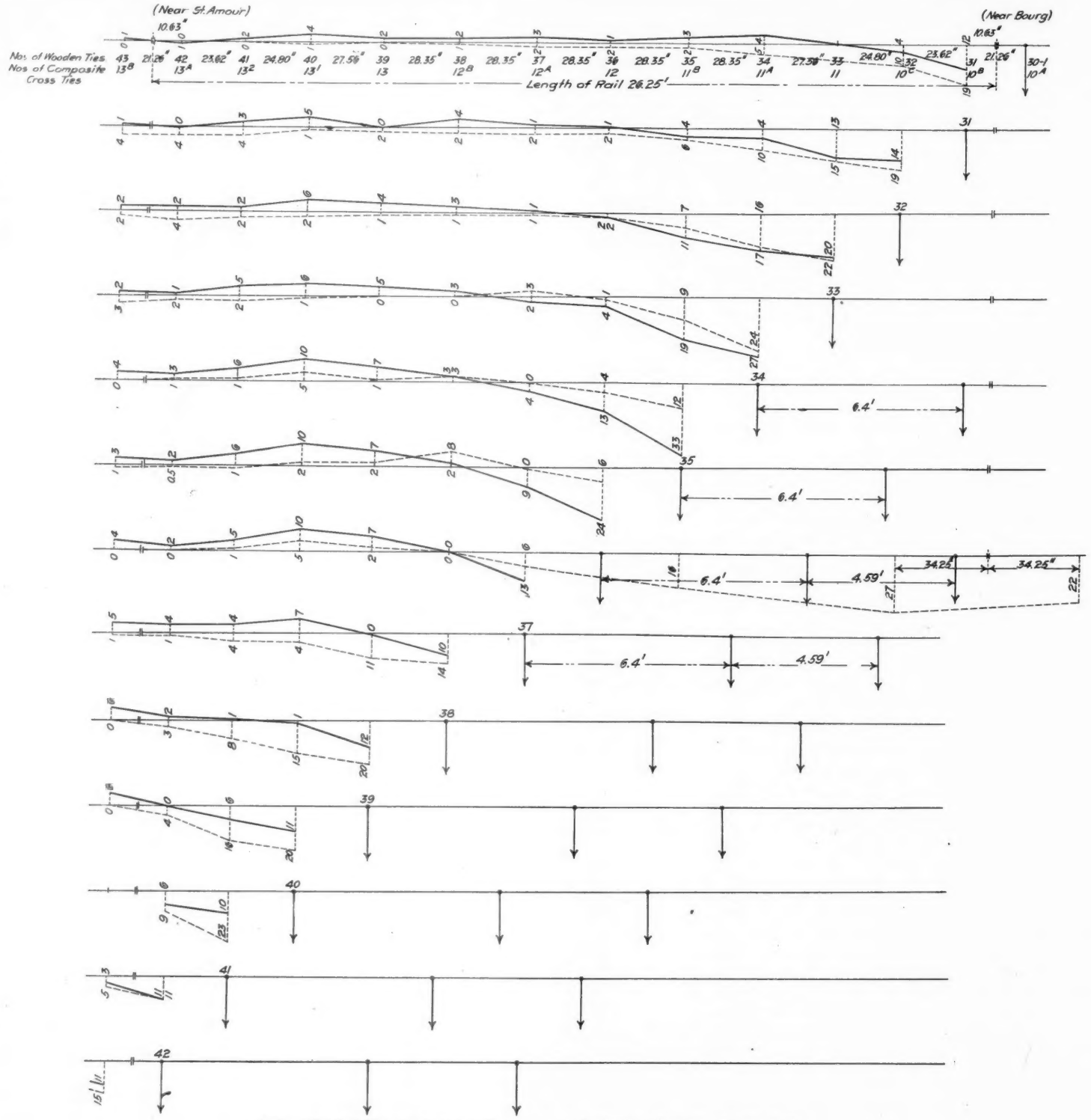


Fig. 4—Rail Deformation Under the Action of a Static Load (Long Radius).

joint (of whatever nature they may be) by the projection of mud on the rail. The hammering of the ballast produces a void under the point of application of the load; this void is filled little by little with the materials of the roadway, which are slowly displaced, falling into the inter-track space or on the outside space, and flowing between the two rails. The ballast is as though screened by the vibration of the cross tie of the following end of the even-joint; the finest materials pass under the rail and cause the coarser materials to ascend in the inter-rail space. In this part of the track it is also remarked that the screw spikes of the cross tie of the following end of the even-joint are subjected to a wrenching, because they support at their lower extremity a hydraulic pressure which expels them from their holes, and that the more rapidly as the insufficiently creosoted wood is submitted to the alternations of dryness and wetness and deteriorates in consequence of the oxidation of the screw spike. In order to have a good track it is very important to select a gravelly ballast purged from earth and above all from clay.

The experiments thus executed in a mediocre ballast, resting on a compressible bed, have then taken place under unfavorable conditions, the results obtained, and the information which will be derived from them will have a bearing which we should not slight.

The most numerous experiments have been carried on in a static state, because it resulted from similar tests made by Mr. Ferry, Sub-Engineer at Bourg, that the flexures in the dynamic state are not superior to those which are realized in a static state. The curve of deformation of cross ties can be modified in its general form, but its parts preserve the same relation between themselves, maintaining the same flexure as in the static state. This fact has been verified on the wood cross ties provided with P. L. M.-A. rails.

The determination of the curves of deformation of cross ties has been made with extreme care, taking all desirable precautions.

MEASURING APPARATUS FOR EXPERIMENTS IN THE STATIC STATE.

There were first placed in the surface of the wood cross ties screws with square heads distributed over their whole length and giving 15 or 16 fixed points, which were to serve as bench marks for the determination of the deformation. A rigid steel rule in the form of a T (Fig. 6) presented, right at the points, whose spacing was the same for all cross ties, vertical rods terminated by a notch, in which was brought, while resting on the screw with square head, a gage in the form of an inclined plane, whose divisions were calculated in a manner to correspond with a tenth of

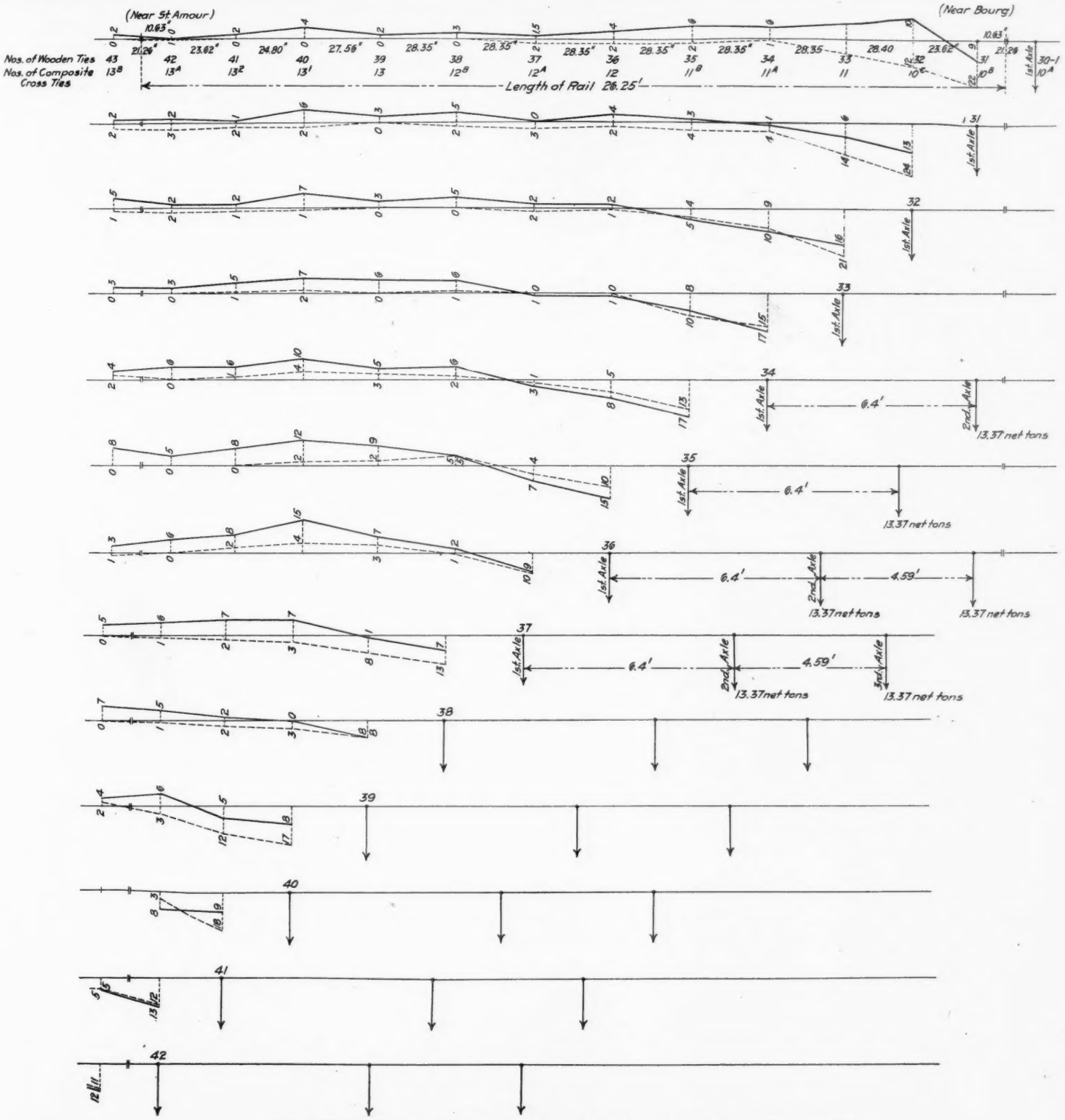


Fig. 5—Longitudinal Deformation of the Rails Under the Action of a Static Load (Short Radius).

a millimeter. The inclination of the inclined plane had been so chosen that the interval between two divisions was at least of 2 centimeters ($^{79}/_{100}$ in.), which allowed estimating the tenth of a millimeter with exactness. The rule was fixed in an unchangeable manner to two stakes of strong dimensions, buried in the embankment about 1 m 10 (3.61 ft.), in order to eliminate the influence of the load on the supports of the rule. When the rule was in place, an observer introduced the wedge-shaped gage in the desired to put it in service. The thumb screw passed through an iron rod and simply rested on the spring which, left free, moved back and forth on the rod fixed by means of two bolts on a stake deeply buried in the soil.

In order to make an observation, the screw is pressed against the spring until the point of the stylus comes in contact with the blackened plate. In this position a light blow is given to it, which makes it oscillate and defines a horizontal trace of 2 or 3 milli-

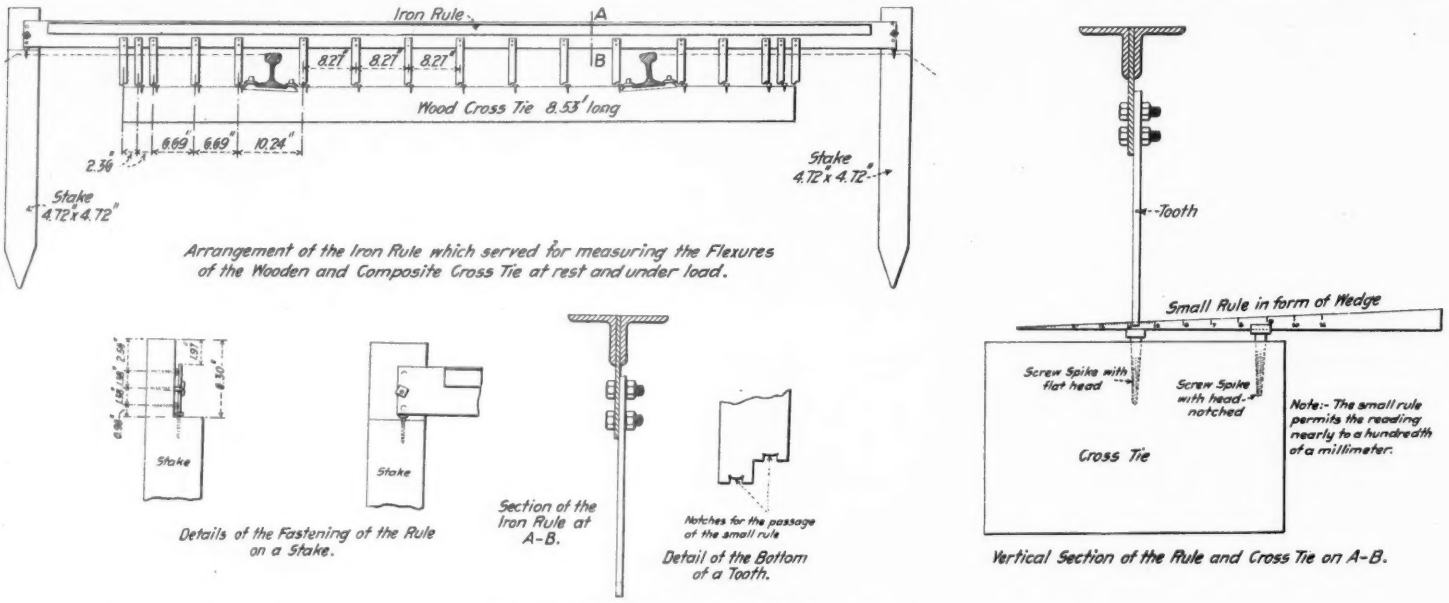


Fig. 6—Flexure of Ties Under Load.

notch, while maintaining it horizontally on the head of the screw, and stopped it at the moment when it commenced to become wedged; he then made a first reading on all the points of reference, proceeding, for example, from left to right, then a second, proceeding in the reverse direction, from right to left. The readings made were recorded by the employees of the Board of Control and those of the P. L. M. Co., and the mean of them was taken, which thus gave the actual position of the cross tie.

The vehicle, which served to load the cross tie considered, was brought up, always taking care to place the same wheels at the same spot, with reference to the piece submitted to the test; it was allowed to remain during about 10 minutes, and the readings were recommenced, which caused some difficulties, since the head observer was obliged to pass under the frame of the engine and to operate stretched out to his full length. In like manner two successive readings were made, and the mean of them was taken, as has been recited above; the difference between the inscribed means gave the deformation of a cross tie under the load considered. It was necessary to count on an hour at least for the aggregate of the readings, and the necessary delays during the passage of trains made the operation require a very long time.

The preparation of the working place and the establishment of the measuring apparatus has been made by Mr. Ferry, Sub-Engineer of the P. L. M. Co., who has carried on experiments of this kind for more than 20 years, and who allies with a consummate experience a sagacity truly remarkable.

MEASURING APPARATUS FOR THE EXPERIMENTS IN THE DYNAMIC STATE.

Mr. Ferry employed for the experiments in a dynamic state a measuring apparatus which had previously served for studying the deformation of cross ties in a static state as well as in a dynamic state. It is extremely simple and strong; it presents then from this point of view an incontestable superiority over the apparatus employed for the same object, which would give perhaps more precise resul , but whose indications require corrections always difficult to make, by reason of the greater delicateness of the measurements (apparatus of Marey). If these corrections are incomplete, the indications given conduce to results which cannot be utilized.

The measuring apparatus (see Fig. 7) was essentially composed of a stylus arranged in a stable manner at the face of a plate of smoked glass and fixed on the points of the cross tie under observation. The black smoke deposited on the glass plate, which was displaced at the same time and by the same amount as the points, was removed by the point of the stylus; the height of the part removed gave the value of the deflection, or of the raising of a cross tie at the points considered. The reading of this height was made by means of a magnifying glass nearly to the tenth of a millimeter.

The stylus, with flat point of tempered steel, was mounted on a very flexible spring, which could be approached to or removed from the glass plate at will, with the aid of a thumb screw. The glass plate was fixed by screws on one of the faces of a cross tie, then smoked in the flame of a candle at the moment when it was

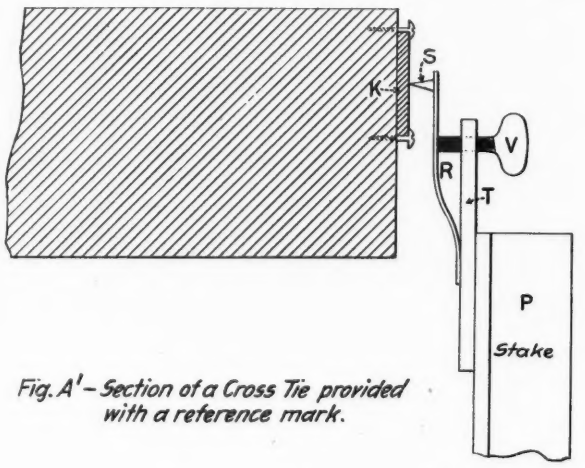


Fig. 7—Flexure of Ties Under Load, Shown by Reference Marks.

meters ($^{8}/_{100}$ to $^{12}/_{100}$ in.) length on the black smoke, a trace which forms the reference mark.

At this moment one can either place the vehicle on the cross tie, or allow trains at speed to pass over it. The height of the part of the glass plate rubbed off by the point of the stylus gives, above the reference mark, the values of the depression, and below, the uplift, of the cross tie. The latter is always inferior to the former; for the flexure is important in comparison with the movement of uplift of this piece under the influence of loads at a distance. The successive influence of each of the axles cannot be noted, but it is solely a maximum indication which is produced.

Mr. Ferry, before providing himself with the rule which we have described above for the study of the deformations in a static state, employed the registering apparatus just above, and determined with exactness the form of that deformation by placing five of these apparatus on different points of the cross tie. He was then able, by comparing the results obtained with the rule and the wedge on the one hand, and the stylus on the other, to appreciate the precision of measurements given by one or the other of these apparatus.

(To be continued.)

GENERAL NEWS SECTION

NOTES.

The Government of Manitoba is to build 1,000 miles of telegraph line and, according to press despatches, contracts for some of the material have already been given in Chicago.

The Railroad Commission of Canada has ordered the Canadian Pacific and the Grand Trunk to reduce passenger fares to 3 cents a mile on all lines east of Edmonton, the change to go into effect May 19.

The number of emigrants going from England to Canada is now very large; but the demands for laborers on the new railroads and other works in western Canada is still unsatisfied. Over 60,000 laborers are wanted.

The Connecticut State Board of Railroad Commissioners has decided that a street railroad whose electric current damages underground pipes by electrolysis must pay for the damage, the amount to be determined by some court of competent jurisdiction.

The President of the Delaware & Hudson announces that in the past 12 years, during which time that road has carried 75,000,000 passengers, there has been only one train accident which was fatal to passengers. In this accident three passengers were killed.

At Prince Rupert, the western terminus of the proposed Grand Trunk Pacific Railway, the 300 men at work on improvements go to bed every night at 9:30, and the place is termed a "model colony." The explanation is that no intoxicants are allowed to be brought in.

F. M. Crump, President of the Memphis Cotton Exchange, reports to the Interstate Commerce Commission the existence of a serious congestion of cotton at Memphis, and the commission proposes to investigate the matter. Mr. Crump says that the railroads now have in that city 23,000 bales of cotton for which they cannot find cars.

The Canadian Pacific has just distributed to station agents and track foremen 35,000 packages of flower seeds. These seeds, with 150,000 bulbs sent out last fall, are expected soon to produce scenes of beauty at hundreds of stations of the company. The flower department of the Canadian Pacific was started ten years ago by N. S. Dunlop, who still remains at the head of it.

The Interstate Commerce Commission announces that in consequence of the large volume of business now coming before it, hearings will no longer be held by the commission, except in Washington. When it is found necessary to take testimony in other cities special agents will be sent out for the purpose; and the arguments will be heard subsequently in Washington.

On account of the unfavorable weather and other obstacles, the Canadian Pacific will not run a "seed special" this year. It is said, however, that the pure seed distributed by the railroad in former years has proved a great benefit to the farmers of the Canadian West. Some years 10 per cent. of the wheat crop is a total loss on account of noxious weeds, and the weeds are increasing.

Mr. T. P. Shonts, President of the Interborough-Metropolitan Street Railroads in New York City, has requested representatives from 50 business and civic associations to appoint delegates to act as an advisory committee to confer with him concerning the transportation needs of the city. Mr. Shonts is considering favorably the adoption, for the subway, of cars with side doors, like those in use on the Illinois Central.

The Railroad Commission of Canada has issued a statement of accidents on the railroads of the Dominion from February 1, 1904, to March 31, 1906, two years and two months. Total number of persons killed, 402; injured, 144. Of the killed, 109 were trespassers. The report says that the commission intends to station inspectors at different places in Canada to investigate accidents, and also to examine cars and engines and to report generally on the conditions of railroad operation.

According to an interview with an officer of the San Pedro, Los Angeles & Salt Lake, printed in a Western paper, the legislature of Nevada has passed a law limiting freight rates to 7½ cents per ton-mile, a rate which, says this officer, will compel the roads to raise to that figure the prices on all classes of goods, in order to make up for the loss on high class goods. Hitherto the roads have been charging 20 cents per ton-mile on first class freight, though at the same time they are carrying some cheaper goods at 1 cent per ton per mile.

On Monday last a decision was announced by the Interstate Commerce Commission in the case of the American Livestock Association and the Texas Cattle Raisers' Association against the Texas & Pacific. The commission holds that the public interest requires the establishment of the through routes and joint rates formerly provided for in joint tariffs. In the case of the Birmingham Packing Company against the Texas & Pacific the commission ordered that a through route and joint rate thereover of not exceeding 50 cents per 100 lbs. be established and maintained for the transportation of cattle in carloads from Fort Worth to Birmingham.

President Roosevelt has decided to appoint an Inland Waterways Commission, with Congressman T. E. Burton, of Ohio, as chairman. The duty of the commission will be to report on a plan for the improvement and control of the rivers of the country. The President says that the railroads are unable to move the agricultural and other products of the country, and that water transportation must therefore be provided. Other men asked to serve on the commission are: Senator Francis G. Newlands, Senator William Warner, John H. Bankhead, General Alexander Mackenzie, Dr. W. J. McGee, Mr. F. H. Newell, Mr. Gifford Pinchot and Mr. Herbert Knox Smith.

Judge Trieber, of the United States District Court in the Eastern District of Arkansas, has handed down a decision sustaining the constitutionality of the Employers' Liability act. It is in the case of Splain against the St. Louis & San Francisco. Judge Trieber agrees with Judge Hanford, in the Western District of Washington, in holding that the enactment was within the powers of Congress. On the other hand, Judges Evans and McCall recently decided that the law was unconstitutional. The government therefore has taken steps to have the question reviewed by the Supreme Court, and, at the request of Attorney-General Bonaparte, who will argue for the constitutionality of the statute, the Supreme Court has advanced the cases on the calendar, and they will be heard on April 8.

According to Chicago papers, the railroads centering in that city intend to protest against the reduction of about 14 per cent. in the pay for mail transportation which must result from the recent order of the postmaster-general to change the basis on which the average daily weight of mail is computed. Heretofore the total quantity of mail carried in a week has been divided by six to give the average daily quantity; under the new order the total is to be divided by seven. The Chicago roads point out, however, that under the new rule it will be to the interest of a railroad to carry no mails on Sunday, which would be a serious inconvenience to the public. But some of the roads are likely to accept the new ruling without protest, so that those who wish to complain are doubtful about the expediency of doing so.

Mr. Albert H. Harris, general counsel of the New York Central, has mailed to Governor Hughes and the members of the New York Legislature a printed letter asking that more money be appropriated by the state to aid in eliminating grade crossings. Mr. Harris complains that the state has so far appropriated a very inadequate sum to meet its share in the abolition of these crying evils. Especially does he urge appropriations by the state for the abolition of the crossings in Ossining, Tarrytown, Irvington, Hastings, Yonkers, White Plains, Scarsdale, Tuckahoe, Bronxville and Mount Vernon, toward which, Mr. Harris says, these municipalities and the railroads are willing to pay their respective shares. Massachusetts has appropriated $7,109,892 up to November 30, 1906, and only about half as many people out of every million have been killed at grade crossings, while New York has appropriated only $1,067,606.

One of the new tracks of the elevated line of the Philadelphia, Baltimore & Washington at Wilmington, Del., has been put in use, and within a few weeks the other will be in service. In the plans for this track elevation a special effort has been made to reduce noise as much as possible, thus reducing to a minimum the annoyance to persons living or doing business near the tracks. There are 24 bridges in all, carrying the main tracks over the street and railroad crossings. The floors of the bridges are solid trough construction. The steel is covered with concrete, which is waterproofed with five layers of felt and asphalt compound. This in turn is covered with a layer of protecting bricks laid in sand and grouted. Upon the bricks is laid the stone ballast, carrying the wooden ties and the rails forming the roadbed. The elevated line is about three miles long. When the improvements are completed they will probably result in the saving of several minutes in the running time between Philadelphia and Baltimore—marking another step, says the press agent of the road, in the accomplishment of the purpose of the Pennsylvania eventually to reduce its running time between New York and Washington to four hours.

Mechanical and Electrical Engineering Courses at Rensselaer.

The trustees of the Rensselaer Polytechnic Institute have decided to establish courses in mechanical and electrical engineering. The recent gift of $1,000,000 from Mrs. Sage and other recent gifts through which they have been able to increase the value of their plant for the purposes of instruction, enables them to do this.

These courses will be as general as the civil engineering course now given at the Institute.

Waiting.
Chicago *Daily Tribune.*

Prosecution of the Lackawanna for Rebating.

In the United States Circuit Court at New York City last week the suit of the government against the Delaware, Lackawanna & Western for making illegal payments to L. M. Palmer, proprietor of the Palmer docks and lighters in New York harbor, came to an end by a disagreement of the jury; and the newspapers say that the government probably will not ask for a second trial, the purpose of the suit having been, not so much to punish the railroad as to secure a judicial construction of certain clauses of the law.

The road was charged with having granted rebates to the American Sugar Refining Company under the guise of lighterage charges to Mr. Palmer, and the prosecution evidently believed that the acts of the railroad had been similar to those of the New York Central, under trial last autumn, in which it was found that payments made by the road to Mr. Palmer were really for the shipper. In the Lackawanna case, however, Mr. Palmer testified that none of the money went to the sugar company. Officers of the road testified that the money was paid to Mr. Palmer because of the loss in traffic sustained by him in consequence of the giving of the Lackawanna lighterage to Starin & Company.

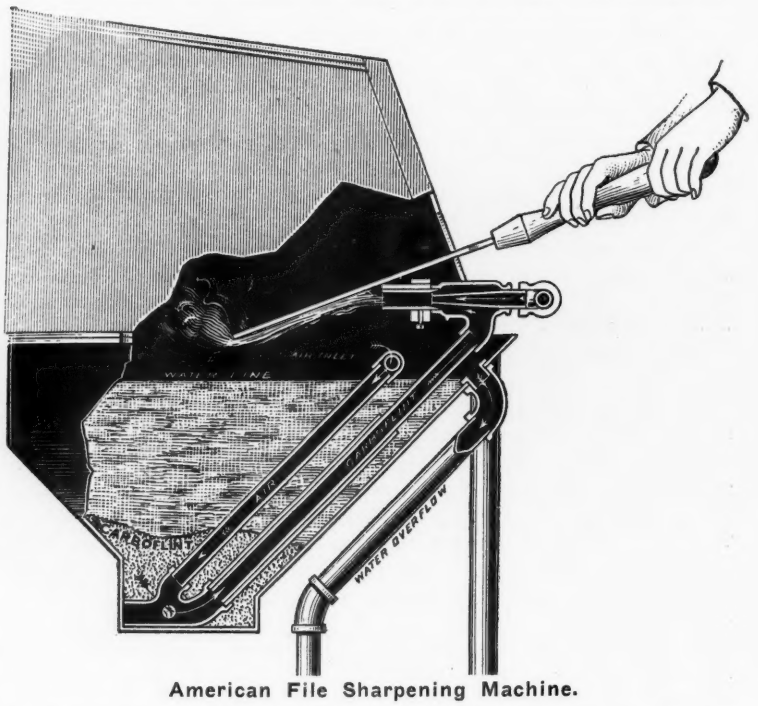
The trunk lines had an agreement for dividing the westbound sugar traffic from New York and Philadelphia, and in 1898 the Lackawanna was to have 4 per cent. of the total from both cities. All the lines except the Pennsylvania and the Lackawanna received their New York sugar at or through the Palmer docks, Brooklyn, but the Lackawanna had an independent dock of its own. Mr. Palmer had close relations with the New York refinery, and the owner of the refinery was interested with him in the ownership of the Palmer docks. An arrangement appears to have been made with the railroads whereby the whole of the 4 per cent. allotted to the Lackawanna was shipped from Philadelphia and none from New York. This did not suit the Lackawanna because it had to divide the revenue with the Reading, and finally the other roads were induced to agree that the Lackawanna should get its percentage (now raised to six) at New York. This was in 1901. Mr. Palmer intimated that it was hard on him to thus voluntarily divert traffic from his own docks and vessels, and the Lackawanna thereupon agreed to do business at his docks; but there was no room, and finally the road agreed to allow him 2 cents per 100 lbs., which was a little less than half of the usual lighterage charge received by him from the other roads. The Lackawanna paid Starin & Company 2½ cents and allowed Mr. Palmer a "cartage" charge of about 2 cents. Vice-President Caldwell, of the Lackawanna, testified that when these allowances were made he did not know that Mr. Palmer was the director of the sugar company. It does not appear that Mr. Palmer performed any service in connection with the Lackawanna shipments.

A Lightning Calculator.

According to a press despatch from Austin, Tex., the General Attorney of a railroad in that state, who has examined the 125 bills affecting railroads which have been introduced this year in the legislature, finds that they would reduce the revenues of the railroads ten millions a year and increase their expenses five millions.

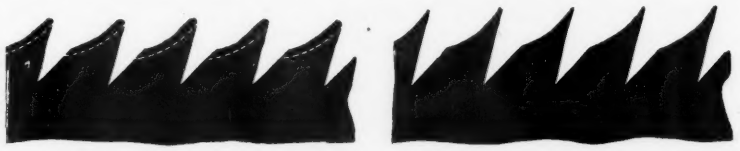
The American File Sharpener.

The accompanying illustration shows a sectional view of an apparatus, made by the American File Sharpener Company, New York, for restoring the cutting edges of worn or dull files. The operating principle of the machine is to force a siphon blast, carrying an abrasive material called "carbo-flynt" which is impelled by a jet of steam or steam and compressed air, at high velocity, against



American File Sharpening Machine.

the dulled file, striking the teeth at an angle of from 15 deg. to 30 deg. The file during the process of being resharpened is drawn forward and backward over the ejector nozzle, inside of which is a reducing jet so adjusted that the carbo-flynt strikes the teeth of the file from the back, thus restoring the sharpness and at the same time preserving the original angle of the teeth. After im-



File Teeth Before Sharpening. **File Teeth After Sharpening.**

pinging against the file the carbo-flynt settles at the bottom of the machine and is used over and over again until it is cut up into fine particles and carried away in solution by the overflow outlet. The machine occupies a floor space 6 ft. x 6 ft., weighs 450 lbs., and is operated by from 80 lbs. to 150 lbs. steam pressure. It is claimed that files sharpened with the device do as good or better work than new files, and that they can be resharpened from four to six times before being discarded. The process being simple an expensive mechanic is not required to operate it, so that the cost of resharpening is small. From 200 to 400 files is given as the daily capacity per machine, according to the condition of the files to be resharpened. Prominent manufacturers and railroad companies now using this device include the Niles-Bement-Pond Company, the Westinghouse Electric & Manufacturing Company, the Illinois Central, the Chicago, Rock Island & Pacific, the Chicago, Burlington & Quincy, and the St. Louis & San Francisco.

Possible Clash Between Federal and State Laws.

The interstate commerce act forbids unjust discriminations, and charges the commission with the duty of enforcing that provision as well as all other provisions. There have been many cases where railroads have been charged with discrimination in the distribution of their available cars in favor of one shipper and against another. The commission has enforced the law in a number of such cases where no question of state legislation was involved. It may be said with some force that the case would be different where a railroad does this under the compulsion of a state law. But would it be different in principle? The federal law is, of course, paramount. It permits unjust discriminations on no grounds whatever. Will it then permit a state law to interfere with interstate traffic? The commission cannot sit idle while interstate traffic is interfered with and in some cases interrupted by the operation of such state enactments. "If interstate carriers are forced by state laws to side track interstate commerce, and if such laws result in putting

all the available cars at the disposition of state shippers, to the prejudice of interstate shippers, it is a clear interference with interstate traffic." When the cars are not sufficient to take all traffic offered, and terminals overcrowded, and when all the loaded cars cannot be moved at the average rate provided by the state laws, what is more natural than the side-tracking of the cars containing the merchandise of interstate shippers, for whose benefit the state penalties are not imposed? This, as we are informed, is being done." —*Commissioner Harlan* (Interview).

Wood Rolling Roundhouse Doors.

Steel rolling doors for roundhouses, freight houses and similar buildings have many advantages, but one serious disadvantage accompanying their use in roundhouses is that steel is readily attacked by the chemical action of the sulphurous fumes due to the smoke. The accompanying illustrations show a rolling shutter door for roundhouses made out of materials which are least affected by acid

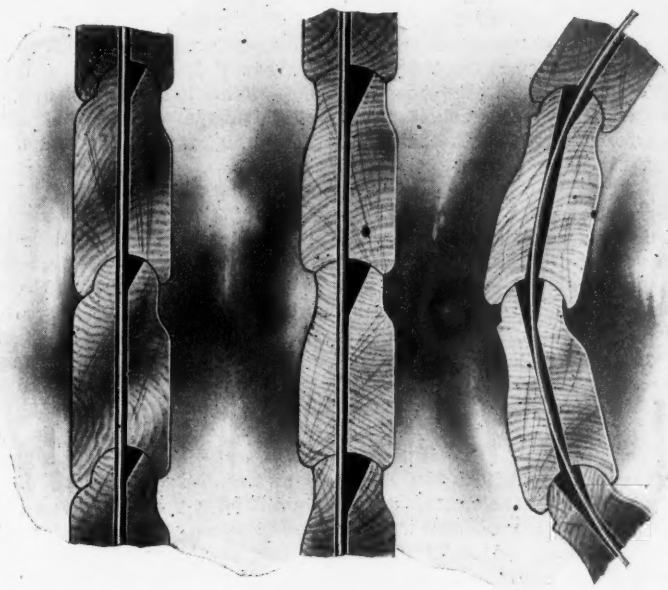


Fig. 1—Forms of Wooden Slats for Rolling Door.

gas, namely, wood, copper and cast iron. These wood rolling doors have all of the advantages of simplicity, compactness and ease of manipulation that characterize steel doors of the same construction. They have been especially designed for roundhouses, and the end clearance is so small that the usual steel post construction between stalls affords ample space on which to mount the grooves in which

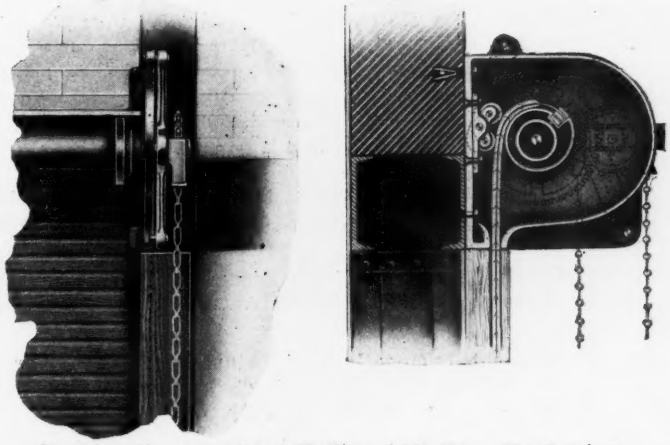


Fig. 2—Kinnear Wood Rolling Lift Door Mechanism.

the doors travel. The curtain is made up of wooden slats mounted on phosphor-bronze ribbons threaded through slots placed about 2½ ft. apart. These slots are accurately designed and cut to such shape that the flexure of the slats when passing around the barrel does not change the relative length of the slats and the suspending ribbons. The metal ribbons are never exposed.

The curtain is suspended and rolls on a barrel made of boiler tube of sufficient diameter to afford the necessary stiffness and large enough to contain within it the helical springs used to counterbalance the weight of the curtain. The ends of this tube are closed by cast iron plugs, thus protecting the springs. Mounted on the barrel are spiral cast iron rings to which the suspending curtain ribbons are attached, so that after the first turn of the slats around the shaft the roll is always a true spiral. Two methods of suspending the barrel and hoisting gears are shown in the illustrations. Fig. 2 shows the barrel and hoisting gears mounted on a horizontal bar which is suspended at its inner end by a link and carried at its outer end by a similar link, the adjustment being such that the curtain hangs vertically in the grooves. Back of the curtain is a pivoted cradle carrying two rollers which bear against the curtain as it is wound up. As the door is raised the curtain is wound on the barrel, and the rollers on the pivoted cradle keep forcing the barrel farther

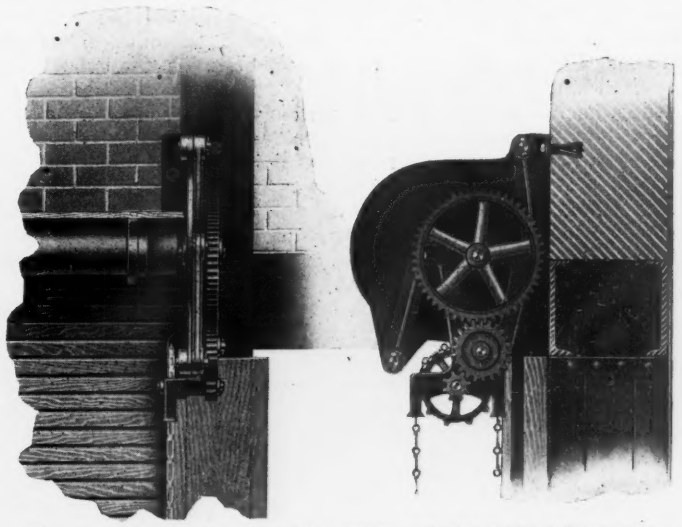


Fig. 3—Mechanism for Use With Limited End Clearance.

and farther out as the diameter of the roll increases, but the curtain is maintained in a vertical position at all times. Fig. 3 shows a modification of this arrangement, in which the horizontal bar link is replaced by a heavy frame extending downward and carrying the chain hoist under and in front of the bracket. This arrangement economizes end clearance and the doors may be placed closer together than with the arrangement shown in Fig. 2. The slats or doors are treated in the shop with a waterproofing compound, but they should be painted after erection. One of these doors, 13 ft. wide and 17 ft. high, has been operated over 1,800 times without showing any appreciable wear. The time required to operate the door is 30 seconds. The Kinnear Manufacturing Company, Columbus, Ohio, are the makers.

Thirteen Passengers Killed in South Africa.

Press despatches of March 13 report the derailment of a night passenger train at Alkmaar on the railroad to Delagoa Bay, in consequence of running into a washout; and that 13 persons were killed and many injured.

Respectfully Referred to Hapgoods.

[Press despatch from Topeka.]

"The Kansas State Board of Railroad Commissioners will hire a rate expert, at $10,000 a year if necessary. Two big undertakings confront the board. First, to examine into freight rates; second, to determine the actual value of all the railroad property in the State. The legislature has placed at the disposal of the board the sum of $25,000. If the right man can be found in Chicago or New York his services will be secured." Why exclude Topeka, London, St. Petersburg, Altoona, St. Paul, Chattanooga and Washington? In passing out $10,000 plums a spirit of fairness should prevail. God Almighty did not exhaust the rate-making stock when he created a few New Yorkers, etc.

No More Coal Scoops at Denholm.

The Pennsylvania has built new coal "wharves" at Denholm, Pa., on the Middle division, and at Thorndale on the Philadelphia division, which will save much time in coaling and watering locomotives. The two plants have the same general features. Each runs across 12 tracks, like a bridge, and 12 locomotives underneath can be supplied with coal from the wharf and water from stand pipes at the same time.

Approaching the Denholm wharf the four main tracks branch out into 12. Not the least of its valuable features is that it makes train crews hurry as they never hurried before. The engineman and conductor of a train dislike, above everything else, to have another train overtake and pass them. At Denholm it is easily possible for one locomotive to pull in behind another, supply itself with coal, water and sand and then move away before its rival.

The first time a train crew were "scooped" at Denholm the men were angry. According to the old way, when one train was stopped it blocked all the other trains behind. Inevitably this led to a complacency among crews not conducive to great haste, and it was not unusual for a train to stay half an hour. Not long after the new wharf was finished recently a locomotive came under it

and the crew began to "coal up" in leisurely manner. But the men on the engine that arrived three minutes later hustled with all their might, and before the crew of the first realized what was happening they saw the second train pull out ahead.

One day not long ago the wharf was put to a severe test. Owing to a delay east of Denholm several westbound trains had become "bunched." When the cause of the trouble had been remedied they all began to press forward. Nineteen trains passed the wharf in 80 minutes. There was but one detention on account of waiting for room. The average stay of a locomotive at the wharf was between 12 and 13 minutes.

The wharf is 210 ft. long. From end to end runs the coal bin lined with solid concrete, with chutes underneath it. Along the top of the wharf is a track for the cars which bring coal from the west. Near one end is a sand tower. Little cars, running on a narrow gage track beside the coal car track, carry the sand out over one side of the wharf to sand bins. From these it passes through chutes to the sandboxes of the locomotives, while the tenders are being loaded with coal.

Below the point where the locomotive stops, and running underneath the 12 tracks, are two arched tunnels. Into one of these opens a chute for ashes from the firebox. An endless chain of ash conveyors runs through each tunnel under the chutes, and on it the ashes and sparks are carried out and dumped into a bin from which they are taken by regular ash cars. There is a power house 100 ft. long and 40 ft. wide, with boilers, dynamos and pumps. In the cellar of the house is an oil storage room, where the various grades of lubricating oil used on a train are kept in steel tanks and forced up from them by air pressure.

Union Switch & Signal Company.

The annual meeting was held at Pittsburg on March 12. The officers and directors were re-elected as follows: George Westinghouse, President and Director; H. G. Prout, Vice-President and Director, and George C. Smith, William McConway, John B. Jackson, Thomas Rodd and Robert Pitcairn, Directors. The annual statement showed a gross business for the calendar year 1906 of $5,065,676, an increase of more than 70 per cent. over the preceding year. The net profits for the year were 45 per cent. on the outstanding capital stock. The dividends were at the rate of 12 per cent. Five thousand shares, $50 each, of new stock was offered to the stockholders at the rate of $80 per share, and all of it was subscribed for. The company has at the present time $2,000,000 worth of unfinished orders in its shops and the prospect for the continuance of orders is such that it has become necessary to provide additional manufacturing facilities. For this purpose the company has recently bought 34 acres of land immediately adjoining its present holding. This land has a frontage on the Pennsylvania Railroad which will enable it to put in switching tracks to great advantage. A new foundry and blacksmith shop, and probably a power house, will be erected at once. Galleries will be built in the existing foundry and blacksmith shop and so add convenient and well lighted floor space for the general manufacturing business. The present floor space in the plant is 355,000 sq. ft. The new building and the galleries in the old building will furnish 140,000 additional sq. ft. Colonel Prout's estimate is that these additional facilities will answer the company's purposes for another year, and he does not now contemplate any building other than the new foundry and smith shop.

The Bigness of Norfolk.

An absolutely unmistakable sign that Norfolk has come to be an important city is the establishment by the Pullman Company of a District Superintendent's office here. There is no more sentiment in the Pullman Company than there is in a corncob, and therefore the recognition of Norfolk as an important point is dictated by business considerations. It is well, too, that sentiment should have nothing to do with this matter. It has no place in such enterprises. Norfolk does not wish to be considered sentimentally. She has been too long treated by the railroads as a way station, or jumping off place.—*Norfolk Correspondent Richmond Despatch.*

TRADE CATALOGUES.

Wallace-Coates Engineering Co.—This Chicago company has a little pamphlet giving the organization and scope of the work of the company. The executive committee is composed of H. U. Wallace, formerly Chief Engineer of the Illinois Central, and Third Vice-President of J. G. White & Co., New York; Frank R. Coates, formerly Chief Engineer of the Chicago Great Western, and Vice-President of Thos. Phee & Co., general contractors; J. F. Wallace, President of the Electric Properties Co., New York, formerly General Manager of the Illinois Central and Chief Engineer of the Panama Canal; T. W. Snow, President of the Otto Gas Engine Co., and Pliny B. Smith, Attorney at Law, Chicago. The officers are: H. U. Wallace, President; F. R. Coates, Vice-President; J. F. Wallace, Treasurer, and M. E. Shire, Secretary.

Crucibles.—The Joseph Dixon Crucible Co., Jersey City, N. J., has published a pamphlet on graphite crucibles by John A. Walker, Vice-President and General Manager of the company. The point is made that most crucibles are perfect when they reach the user, and most of their failures are due to bad usage; accordingly it gives rules for their treatment, telling how to put the metal in, how to put the crucible in the fire, what sort of fuel to use, the proper tongs and how they should be handled, etc. It describes specific troubles and tells how to avoid them. In addition, the pamphlet contains tables showing the make-up of the principal alloys, the freezing, fusing and boiling points of certain materials, and some general information and tables useful in foundry work.

Sanding Devices.—The 1907 catalogue of the American Locomotive Sander Co., Philadelphia, Pa., describes Leach and "She" sanders and Sherburne's arrangement for automatic sanding. Different types and fittings of the Leach sanders are shown, suited to different wheel arrangements; the double sander feeding in front of the leading drivers and behind the rear drivers, and the triple sander fitting also between the wheels. The illustrations are unusually attractive, most of them being transparencies; they show the arrangements in the sand-box, the piping, the valves and other parts.

Car Barn Doors.—The Kinnear Manufacturing Co., Columbus, Ohio, sends an illustrated pamphlet describing Kinnear steel rolling doors for car barns. These doors are made of horizontal steel slats hinged together along their entire length. They roll up at the top of the barn opening on a barrel counterbalanced by helical springs. The slats are corrugated to prevent buckling, and the door runs in vertical grooves. They are usually worked by hand through sprocket wheels and gears, but the company has lately worked out a system for operating them with electric motors.

University of Illinois Railroad Courses.—Information concerning the School of Railway Engineering and Administration of the University of Illinois, which was established a year ago, was given in these columns at that time. The university has just issued a little pamphlet which gives concise information concerning these courses, the equipment for same, etc. More detailed information can be obtained from the registrar of the university. A bulletin giving full detailed information is soon to be issued. It will be for general distribution.

Gasolene and Oil Storage Outfits.—A pamphlet sent by S. F. Bowser & Co., Ft. Wayne, Ind., illustrates and describes their gasolene storage outfits for automobiles, and their oil cabinets especially suited to this service.

Machine Tools.—The March number of the *Progress Reporter*, published by the Niles-Bement-Pond Co., New York, has some excellent illustrations of heavy machine tools, including lathes, planers, drills and presses.

Manufacturing and Business.

William C. McMillan, President of the Michigan Malleable Iron Company, died at his home in Detroit on February 21, at the age of 45.

J. H. Burwell, Fisher Building, Chicago, Ill., has been made sales agent in the middle west for the Automatic Ventilator Company, New York.

The Independent Pneumatic Tool Company, Chicago, has received a large order for Thor piston air drills and pneumatic hammers from the Wisconsin Engine Company, Corliss, Wis.

The Pressed Steel Car Company has moved its western office, in charge of J. H. Mitchell, Manager of Sales of the Western district, from the Fisher Building to the Old Colony Building, Chicago.

The Power Specialty Co., New York, reports recent orders for Foster superheaters aggregating many thousand horse-power from several companies, including the Illinois Central, the Bucyrus Company and the Philadelphia Electric Company.

W. J. Dolan, formerly with the Remington Typewriter Co., and more recently with L. P. Smith Bros., of Syracuse, N. Y., has been appointed to a position in the sales department of the Dayton Pneumatic Tool Company, with office at Pittsburg, Pa.

Walter D. La Parle has opened an office at 1513 Manhattan Building, Chicago, and will represent the following companies: J. W. Faessler Mfg. Co., Moberly, Mo.; U. S. Nut Lock Mfg. Co., Ft. Worth, Tex.; Truss & Cable Fence Co., Cleveland, Ohio; Western Tool & Mfg. Co., Springfield, Ohio; Minimax Supply Co., Chicago, and Lincoln-Williams Co., Taunton, Mass.

The Standard Asphalt & Rubber Co., Chicago, announces the following appointments: H. T. Snell, formerly General Manager of the Eastern division of the Standard Oil Co., Vice-President; Samuel McRoberts, formerly Treasurer of Armour & Co., Chicago, Vice-President; W. H. Lawrence, formerly General Inspector of Bridges of the Chicago & North-Western, as Engineer; W. H. Lonsdale, formerly General Superintendent and Hydrocarbon Expert of the American Asphalt & Rubber Co., Chicago, Representative.

J. F. W. Bunsen has gone to Muralt & Co., Engineers and Contractors, New York, in charge of the company's southern office in Charleston, S. C. Mr. Bunsen, who is a nephew of the late Prof. Bunsen, the inventor of the burner which bears his name, has for some years been designing and erecting important engineering works. At the time of the Galveston flood, when he was Mechanical Superintendent of the Southern district of the American Cotton Co., he prepared designs and plans for a system of breakwaters for Galveston, and the present breakwater system was built nearly in accordance with them.

The offices of the Safety Car Heating & Lighting Company and the Pintsch Compressing Company, New York, have been removed to the seventeenth floor of the United States Express Building, Trinity place and Rector street. The management of the Prussian State Railways has decided to change the equipment of all cars to incandescent gas lighting before the end of the year 1909; and after that date they will make only Pintsch gas and not Pintsch gas enriched with acetylene. Acetylene has been found to be much more expensive in Germany than oil gas. All new cars, about 3,800, to be built during 1907 will be equipped with mantle lamps. The Saxony Imperial State Railways have adopted the same method of lighting.

Iron and Steel.

The Texas Traction Co. has ordered 9,000 tons of rails.

The Illinois Central has ordered 6,000 tons of bridge steel.

The Norfolk & Southern will soon let contracts for a bridge over Albemarle Sound.

Contracts are reported let for various electric lines aggregating about 4,000 tons of rails to the Carnegie Steel Company, and for 3,000 for the Lehigh Valley to the Lackawanna Steel Company.

The contract for the general construction work on the Brooklyn approach to the Manhattan bridge, New York, has been let to the F. W. Carlin Company, of Brooklyn. Contracts for about 800 tons of steel to carry out the work will be let shortly.

The American Bridge Company, during the second week of March received orders for 11,000 tons of fabricated steel, including 1,000 tons for the American Sheet & Steel Plate Company, and an additional order of between 700 and 800 tons for the power house at the Gary plant.

The Illinois Central, it is said, has ordered 6,000 tons of steel for bridges from the American Bridge Company. The Great Northern is negotiating for 6,500 tons and between 4,000 and 5,000 are pending for the Lehigh Valley, the Erie, the Tidewater and the Pittsburg & Lake Erie.

OBITUARY NOTICES.

Henry T. Jaeger, General Agent of the Erie at Buffalo, N. Y., died in Buffalo on March 19, a week after he had been operated on for appendicitis. Mr. Jaeger was 46 years old and had been in the service of the Erie for 25 years.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Civil Engineers.

At the meeting of this society on March 20, a paper on "Lower Colorado and the Salton Basin" by C. E. Grusky was presented for discussion. This paper was printed in the *Proceedings* for February, 1907.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Erie.—George N. Orcutt, General Claim Attorney, has been appointed General Attorney, with office at New York City, and his former position has been abolished. Mr. Orcutt will have charge of the claim department together with his new duties.

Missouri Pacific.—Stuyvesant Fish, who was recently elected a Director, has been made also a member of the Executive Committee.

Texas & Pacific.—Robert C. Clowry and Benjamin Nicoll have been elected Directors, succeeding, respectively, James H. Hyde and Louis Fitzgerald. A. C. Bird, Vice-President, has resigned.

Western Maryland.—B. F. Bush, President of the Consolidated Coal Company and the Western Coal Company, has been elected President of the Western Maryland, succeeding Winslow S. Pierce, resigned. F. S. Landstreet, Vice-President of the Western Maryland, has resigned.

Operating Officers.

Buffalo, Rochester & Pittsburg.—E. J. Devans has been appointed Superintendent of the Buffalo and Rochester divisions, with office at Rochester, N. Y., John McGarvey having been granted leave of absence because of ill health.

Great Northern.—H. A. Kennedy, Assistant General Superintendent at Spokane, Wash., has been appointed Assistant General Manager, succeeding to the duties of George T. Slade, General Superintendent, who recently resigned to go to another company. The four offices of Assistant General Superintendent have been abolished. F. S. Forest, heretofore Assistant General Superintendent at Minot, N. Dak., has been appointed General Superintendent at Spokane, Wash., succeeding to the duties of Mr. Kennedy. R. W. Bryan, General Superintendent of Transportation, has been appointed General Superintendent at Minot, succeeding to the duties of Mr. Forest. W. C. Watrous, formerly Superintendent of Transportation of the Missouri Pacific, succeeds Mr. Bryan. E. L. Brown, Assistant General Superintendent at St. Paul, has been appointed General Superintendent at that place. D. M. Philbin, Assistant General Superintendent at Superior, Wis., has been appointed General Superintendent at that place.

Lehigh & New England.—R. G. Kenly, Trainmaster of the Lehigh Valley at Easton, Pa., has been appointed General Superintendent of the Lehigh & New England, succeeding to the duties of J. R. Whitney, General Manager, resigned on account of ill health.

Lehigh Valley.—C. S. O'Neill has been appointed Trainmaster at Easton, Pa., succeeding R. G. Kenly. See Lehigh & New England.

Mexican Central.—H. D. Myers, Trainmaster at Guadalajara, Jalisco, has been appointed Acting Superintendent at that place, E. S. Banks having been granted leave of absence.

Missouri, Kansas & Texas.—J. L. Walsh, Assistant Superintendent at Parsons, Kan., has been appointed Acting Superintendent at that place, succeeding J. W. Walton, Superintendent, resigned to go to the St. Louis & San Francisco.

New York Central & Hudson River.—J. P. Bradfield, Assistant General Manager, has been given leave of absence on account of ill health. P. E. Crowley, General Superintendent of the Western district, has been appointed Assistant General Manager, with office at New York City. J. H. Hustis, Superintendent of the Hudson and Putnam divisions, succeeds Mr. Crowley, with office at Syracuse, N. Y. F. T. Slack, Assistant Superintendent of the Hudson and Putnam divisions, succeeds Mr. Hustis, with office at Grand Central Station, New York.

Miles Bronson, who was recently appointed Superintendent of the River division, was born on May 8, 1875, in the village of Gauhati, Province of Assan, British India. He began railroad work in 1890 in the law department of the Grand Trunk at Detroit, Mich. After five years he was made secretary to S. R. Callaway, President of the New York, Chicago & St. Louis. In 1897 he was appointed Superintendent of the Buffalo Terminal, which was then under construction; before the road was opened, however, Mr. Callaway went to New York to succeed C. M. Depew as President of the New York Central & Hudson River, and Mr. Bronson went with him as his secretary. He was later appointed Assistant to the President. In November, 1900, he was appointed Superintendent of the Har-

Miles Bronson.

lem division, where he remained until he was transferred to the River division early this month.

George Van Tassel, recently appointed Superintendent of the Harlem division, has had 34 years continuous service on the New York Central. He was born on January 11, 1856, at North Salem, N. Y. He was educated at North Salem Academy, and began railroad work in the spring of 1872 as an operator at Croton Falls, on the Harlem division of the New York Central; he was transferred to different stations during the next few years, and was made despatcher at Dover Plains, N. Y., in 1880. In 1889 he was appointed chief despatcher at White Plains, N. Y., and in 1900 was made Trainmaster of the Harlem division, where he remained until his recent promotion.

George Van Tassel.

Frederick T. Slack, the new Superintendent of the Hudson and Putnam divisions, was born on July 27, 1849, at Stonington, Conn. He was educated at the common schools and Academy at Mystic, Conn., and began railroad work in 1868 as a brakeman on the New York Central. He worked on the Eastern division for several years, and then on the Harlem division, being made baggageman and then conductor. In 1886 he was transferred to the Hudson division, where, in 1889, he was made conductor of the first Chicago Limited. In 1892 he was appointed station master at Grand Central Station, New York City, and in 1895 was appointed Passenger Trainmaster of the Hudson division. In 1906 he was appointed Assistant Superintendent of this division, where he remained until his recent promotion.

Frederick T. Slack.

Southern.—M. M. Richey, General Superintendent of the Middle district, has been appointed to the new office of Manager of the Middle and Western districts, with office at Atlanta, Ga. J. N. Seale, Manager of Transportation, has been appointed to the new office of Manager of the Northern and Eastern districts, with office at Washington, D. C., and the office of Manager of Transportation has been abolished.

Traffic Officers.

Durham & Southern.—See Seaboard Air Line.

Rutland Railroad.—See New York Central & Hudson River.

Seaboard Air Line.—R. I. Cheatham, Traffic Manager of the Durham & Southern, has been appointed Assistant General Freight Agent of the Seaboard Air Line at Norfolk, Va., effective April 1.

Engineering and Rolling Stock Officers.

Chicago, Burlington & Quincy.—J. C. Sesser has been appointed Engineer of Maintenance of Way at St. Louis, succeeding L. F. Goodale, resigned to go to the Philippines. R. W. Willis has been appointed Engineer of the Missouri district, with office at St. Louis, succeeding A. W. Newton, promoted.

Northern Pacific.—W. C. Taylor has been appointed Acting Division Engineer in charge of the lines east of Mandan, with office at St. Paul, Minn.

South & Western.—A. W. Jones, Division Engineer at Clinchport, Va., has been appointed Assistant Chief Engineer, with office at Johnson City, Tenn. C. L. Ruffin succeeds Mr. Jones.

LOCOMOTIVE BUILDING.

The Temiskaming & Northern Ontario has ordered six locomotives from the Locomotive & Machine Company of Montreal.

The Cumberland River & Nashville, Louisville, Ky., which is about to build a 20-mile line, is in the market for second-hand locomotives.

CAR BUILDING.

The Intercolonial is figuring on ordering one passenger coach from the Pullman Co.

The Norfolk & Western has ordered 243 40-ton flat cars from its Roanoke, Va., shops.

The O. F. Jordan Co. has ordered five flat cars from the Hicks Locomotive & Car Works.

The New York Central & Hudson River has ordered 35 passenger coaches from the Pullman Co.

The Canadian Northern has ordered one cafe car to be built in the United States for delivery this summer.

The George Palmer Lumber Co., La Grande, Ore., it is reported, has ordered 300 yard cars from the La Grande Iron Works.

The Seaboard Air Line has ordered 50 36-ft. Hart convertible cars of 80,000 lbs. capacity from the Rodger Ballast Car Co.

The Cumberland River & Nashville, Louisville, Ky., which is about to build a 20-mile line, is in the market for second-hand cars.

The Cedar Rapids Refrigerator Express, Cedar Rapids, Iowa, as reported in the *Railroad Gazette* of January 25, has ordered 35 refrigerator cars from the American Car & Foundry Co.

The Norfolk & Western, as reported in the *Railroad Gazette* of March 8, has ordered 1,000 drop bottom gondola cars of 50 tons capacity from the Western Steel Car & Foundry Company, for June delivery. These cars will weigh 38,100 lbs., and will measure 38 ft. 2½ in. long, 8 ft. 11½ in. wide and 4 ft. high, inside measurements, and 40 ft. long, 9 ft. 11 in. wide and 7 ft. 11½ in. high, over all. Bodies will be of wood and underframes of steel. The special equipment includes:

Bolsters	Sectional, plates and angles
Brake-beams	N. & W. standard deck beam
Brakes	Westinghouse
Brasses	Ajax plastic bronze
Draft rigging	Butler
Dust guards	Wood
Springs	Union Spring Mfg. Co. and Pittsburg Steel & Spring Co.
Trucks	Barber

The Louisiana & Arkansas, as reported in the *Railroad Gazette* of March 15, has ordered 300 box cars of 60,000 lbs. capacity from Barney & Smith, for April and May delivery. These cars will be 36 ft. long, 8 ft. 6 in. wide and 7 ft. 2 in. high, inside measurements. The special equipment is as follows:

Axles	Carnegie steel
Bolsters	American Steel Foundries
Brake-beams	Simplex
Brake-shoes	American Brake-shoe & Foundry Co.
Brakes	Westinghouse
Brasses	More-Jones Brass & Metal Co.
Couplers	Tower
Door fastenings	Jones
Draft rigging	Miner
Journal boxes	Barney & Smith
Paint	M. B. Sydam Co.
Roofs	Murphy
Springs	Railway Steel Spring Co.
Trucks	Arch bar
Wheels	Barney & Smith

The Terminal Railroad Association, St. Louis, Mo., as reported in the *Railroad Gazette* of March 8, has ordered 10 six-wheel switching locomotives from the Baldwin Locomotive Works for July and August delivery. The specifications are as follows:

General Dimensions.

Total weight	138,000 lbs.
Diameter drivers	51 in.
Diameter cylinders	20 x 26 "
Type boiler	Straight-top, radial stay
Boiler, working steam pressure	200 lbs.
Tubes, number	323
" material	Charcoal iron
" diameter	2 in.
" length	10 ft. 5 "
Firebox, length	9 ft. 3/16 "
Firebox, width	3 ft. 6⅛ "
Grate area	31½ sq. ft.
Heating surface, total	1,914 "
Tank capacity	5,000 gals.
Coal capacity	9 tons

Special Equipment.

Air brakes	Westinghouse
Boiler lagging	Magnesia
Brake-shoes	Perfecto
Couplers	Climax
Injector	Simplex
Safety valve	Ashland
Sanding devices	Leach
Sight-feed lubricators	Nathan
Steam gages	Ashcroft
Tires, driving wheels	Midvale

RAILROAD STRUCTURES.

Altoona, Pa.—The Pennsylvania, it is said, has given a contract to Armstrong & Latta, of Philadelphia, for a new freight

station, with two transfer sheds, the work to be completed by the middle of July next.

AMHERST, N. S.—Bids are wanted March 29, by D. Pottinger, General Manager of the Intercolonial, for a passenger station at this place.

KENORA, ONT.—Contract has been given to Kelly Bros. & Co., for putting up a large roundhouse here for the Canadian Pacific.

LANCASTER, PA.—The Pennsylvania, it is said, is replacing the bridge at Mulberry street with a new structure.

LITTLE ROCK, ARK.—A permit has been granted by the Building Department to put up a new union passenger station at a cost of about $183,000.

MACON, GA.—The new shops which the Central of Georgia is planning to build at this place will cost $1,400,000.

MATTOON, ILL.—The Cleveland, Cincinnati, Chicago & St. Louis, it is reported, will put up a 40-stall roundhouse here.

MEMPHIS, TENN.—The railroads interested, which for a long time have had under consideration the question of building a union passenger station, have organized a company to carry out this work.

NORFOLK, VA.—The Norfolk & Western Railroad and the Tidewater Railway have plans ready for putting up a joint station at the east end of Main street. The Norfolk & Southern may also use the proposed structure.

OTTAWA, ONT.—The Transcontinental Railroad Commission is asking bids for putting up six steel bridges on the Grand Trunk Pacific.

PRINCE RUPERT, B. C.—The Grand Trunk Pacific, it is said, will at once build a wharf at Porpoise Bay, near this place.

SHAWNEE, OKLA.—The Chicago, Rock Island & Pacific, it is reported, will build a new station and yards to cost $100,000.

SPRINGFIELD, OHIO.—Plans are under way by the Pennsylvania for putting up a new passenger station, also a freight house here.

SUPERIOR, WIS.—The Philadelphia & Reading Coal & Iron Company has given a contract to the Duluth & Superior Dredging Company for the dredging work for its new dock on Superior Bay, which is to cost about $500,000.

TOPEKA, KAN.—The Union Pacific, it is said, will build a 30-stall roundhouse in North Topeka, to cost $64,000.

WINNIPEG, MAN.—The Canadian Pacific has plans for improvements to roundhouses at Moose Jaw and Souris; also at Swift Current, Lethbridge, Strathcone and Cranbrook. N. E. Brooks, Division Engineer of Calgary, Alb., will have charge of the work.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARIZONA, NEW MEXICO & COLORADO.—Organized in New Mexico, with a capital of $1,000,000, to build a line from a point on the Southern Pacific in Arizona northeast to Farmington, N. Mex., which is on the Denver & Rio Grande. H. B. Cerveny is President, F. McLaughlin, Secretary and Treasurer; C. B. Davis, Chief Engineer, and F. W. Kinne, General Manager, all of Fort Worth, Tex.

BANGOR & AROOSTOOK.—A charter has been granted this company to build an extension from Seboeis, Me., north 140 miles, via Chesuncook Lake over the Allaguash river and St. John divide down the Allaguash river valley past Allaguash Falls to St Francis. The plans for this extension were opposed by the Somerset Railway, that company having planned to build into the same territory from its present northern terminus at Birch Point, on the west shore of Moosehead Lake. The matter was compromised, the Bangor & Aroostook having been granted permission to build on the east bank of the Allaguash river, and the Somerset agreeing not to build within ten miles of that river. A charter has been granted the Somerset to build an extension under these conditions; also for an extension from Birch Point west toward the St. Francis branch of the Quebec Central.

CHANDLER & SHAWNEE.—Incorporated in Oklahoma with $600,000 capital, with office at Chandler, to build from Chandler, Okla., south to Shawnee, 30 miles. W. R. Gulick, F. S. Dimon, J. F. Collar, M. D. Owen, F. P. Hoyt, G. B. Rittenhouse, H. G. Stettmund and W. G. Schlegel, of Chandler, incorporators.

CHICAGO, LAKE SHORE & SOUTH BEND (ELECTRIC).—President Hanna, of this company, which is building 71 miles of road from South Bend, Ind., west to Chicago, Ill., has grading completed for 25 miles and 15 miles of track laid. The company is also putting up a central power house at Michigan City. (Mar. 15, p. 381.)

ELK VALLEY & ONEIDA.—Incorporated in Tennessee with $50,000 capital to build from Elk Valley, Campbell County, on the Southern west to Oneida in Scott County, 15 miles. H. C. Lindsay, C. H. Smith, R. N. Kesterson, R. S. Young and J. O. Smith, incorporators.

INTERNATIONAL TRACTION.—President Pierce is quoted as saying that this company will build during the next 18 months a new double-track line over the right-of-way now owned by the company, between Buffalo and Niagara Falls, connecting at Tonawanda with the Lockport division. Some additional tracks are to be laid in the city of Buffalo to relieve the present congestion.

MEMPHIS RAILROAD TERMINAL.—Incorporated in Tennessee, with $100,000 capital, to build a union station and terminals in Memphis. The estimated cost of the station is $3,000,000 and of the grounds and connections about $2,000,000. A. W. Sullivan, of the St. Louis, Iron Mountain & Southern; S. T. Fulton, of the Chicago, Rock Island & Pacific; C. R. Gay and F. H. Britton, of the St. Louis & San Francisco; J. L. Lancaster, of the Union Railway of Memphis; W. S. King, of the Yazoo & Mississippi Valley; W. J. Harahan, of the Illinois Central; G. E. Evans, of the Louisville & Nashville; C. H. Ackert, of the Southern; J. W. Thomas, of the Nashville, Chattanooga & St. Louis, and John H. Watkins, of the Bank of Commerce & Trust Company of Memphis, are directors.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—Contract has been given to Foley Bros., of St. Paul, and work is to be started at once on a branch line from Brooten, Minn., northeast via Freeport, Royalton and Superior to Duluth, about 200 miles. The proposed line with terminals at Duluth is to cost about $8,000,000.

MISSISSIPPI ROADS.—Application has been made by a company in Mississippi to build a line from Gulfport, Miss., north to West Point, 250 miles, where connections can be made with the Southern; the Canton, Aberdeen & Nashville, and the Mobile & Ohio. This is supposed to be a Frisco project.

NASHVILLE & COLUMBIA (ELECTRIC).—Surveys are being made by this company to build from Nashville, Tenn., southwest to Mount Pleasant, 50 miles. Contract for the work has been let to Patrick Hirsch, of New York.

NEW YORK & PITTSBURG AIR LINE.—This company, formerly the Pittsburg, Johnstown, Ebensburg & Eastern, is selling bonds to secure funds for extending its road. The line is now in operation for about 13 miles, from Philipsburg, Pa., where connection is made with the Beech Creek Railroad at the union station. An extension is projected southwest via Johnstown to Somerset, Pa., where a connection can be made with the Baltimore & Ohio.

NEW YORK CENTRAL & HUDSON RIVER.—A bill is being framed to be introduced in the state legislature, to secure the removal of this company's tracks from the surface at Eleventh avenue in New York City. This line is used mostly for freight. It provides for a side track subway between 30th and 62d streets. From 146th to Spuyten Duyvil the right of way is to be walled up at the expense of the railroad and covered at the expense of the city. Between 122d and 146th streets the railroad will run on an elevated structure. Below 30th street, the bill provides that within eight months after it becomes a law, the railroad company shall submit a plan for improvements, other than an elevated structure, which is prohibited. The railroad company is to have three months from the passing of the law in which to file its plans and make terms under which the improvements are to be carried out, and must complete the work within four years.

NEW YORK, NEW HAVEN & HARTFORD.—Plans to elevate the main line of this company in Meriden, Conn., at a cost of between $2,000,000 and $3,000,000 have been submitted to the local authorities. The work includes two new freight houses, extensive alterations to the passenger station, elevated sidings to factories, and concrete bridges in place of the existing grade crossings.

NORFOLK & SOUTHERN.—The Raleigh branch, between Raleigh, N. C., and Zebulon, 24 miles, will be opened for business March 25.

The Columbia branch, between Mackey's Ferry, N. C., and Creswell, 13 miles, was opened for business on March 18.

NORTH DAKOTA.—Organized in North Dakota with $200,000 capital to build from Olga Township to Edenburg, 21 miles, where connection is to be made with the Great Northern.

NORTH LOUISIANA.—Organized in Arkansas with $150,000 capital to build from Cleora, La., on the St. Louis, Iron Mountain & Southern, east to Lake Providence, 40 miles. W. E. Farrell, of Cleora, President; R. E. Farrell, Vice-President; H. Kahn, Secretary and Treasurer, all of Little Rock, Ark.

OKLAHOMA, TEXAS & WESTERN.—Contract let to Donald Fitzgerald for the entire construction and equipment of this proposed line from Clinton, Okla., to Canadian, Texas, 108 miles.

PENNSYLVANIA.—Bids are wanted April 22 at the office of the Pennsylvania, New York & Long Island Railroad, 85 Cedar street, New York City, for work on the East river division, including the construction of tunnels and approaches and bridge superstructures between points near East avenue and points near Thomson avenue in Long Island City. Specifications and other particulars may be obtained from the Chief Engineer at 1 West 34th street, New York City.

Pennsylvania, New York & Long Island.—See Pennsylvania.

Pennsylvania System.—The record of the mileage of the road on December 31, 1906, shows that the total length of main line on the lines east of Pittsburg and Erie is 5,251 miles, with 1,772 miles of second track, 566 miles of third track, 457 miles of fourth track, and 4,136 miles of company's sidings; a total of 12,182 miles. There was an increase during 1906 of 65 miles of first track, 161 miles of second, third and fourth tracks, and 248 miles of company's sidings; a total increase of 474 miles. On the Pennsylvania Lines West of Pittsburg and Erie, the mileage is 2,865 miles of first track, 1,165 miles of second track, 137 miles of third track, 81 miles of fourth track, and 2,220 miles of company's sidings; a total mileage of 6,468 miles. During the year there was a decrease of one mile of first track, and an increase of 87 miles of second track, third and fourth tracks, and 101 miles of company's sidings; a total increase of 187 miles. The mileage of the Vandalia Railroad is: First track, 923 miles; second track, 65 miles; sidings, 613 miles; a total of 1,601 miles. During the year there was a decrease of five miles of first track, and an increase of 18 miles of sidings, making a total increase of 13 miles. The grand total of all lines, including those operated by and associated in interest with the Pennsylvania Railroad, is 10,978 miles of first track, 3,186 miles of second track, 722 miles of third track, 548 miles of fourth track, and 7,675 miles of sidings; a total of 23,109 miles. Of this 6,110 miles of first track are east and 4,868 miles are west of Pittsburg and Erie.

Philadelphia Rapid Transit.—This company has opened the Market street elevated road from Schuylkill river, Philadelphia, west to the upper Darby terminal station, and cars now run through from Fifteenth and Market streets, four miles, to Darby, using the subway to the Schuylkill river.

Pittsburg, Johnstown, Ebensburg & Eastern.—See New York & Pittsburg Air Line.

Portage Bay & Cobalt.—A syndicate composed of men from Haileyburg and New Liskeard, Ont., is planning to build, under this name, an electric line from Haileyburg, Ont., to New Liskeard, 27 miles.

Quebec & Lake Champlain.—Application made to the Quebec Legislature by J. C. Langelier, of Quebec, the attorney for the company, for permission to build from Quebec to Lake Champlain.

St. Paul Terminal.—Under this name a company is being formed to build a line from St. Paul, Minn., to the stock yards in South St. Paul. The plans include the laying of about 50 miles of new track. The company proposes to put up a roundhouse in South St. Paul. William Mavigny, of Sioux City, Iowa, is President, and Joseph Strawhorn, of St. Paul, General Manager.

Somerset.—See Bangor & Aroostook.

South & Western.—Contracts are said to be let to Carpenter & Moxley, of Knoxville, Tenn., for work on this road from Hill's Station, Scott County, Va., to Guest river in Wise County, 40 miles.

Texas State.—The road from Rusk, Tex., west, in operation for 10 miles, which is owned by the state, is to be extended west 18 miles further to a connection with the International & Great Northern, at Palestine; also from the eastern terminus at Rusk east six miles to a connection with the Southern Pacific.

Texas Traction.—A mortgage has been given by this company to secure funds for construction. The line is under construction from Dallas, Tex., to Sherman, 63 miles. Entrance into Dallas is to be made over the tracks of the Dallas Consolidated Electric Street Railway. The company will build a power house at McKinney, midway between Dallas and Sherman. J. F. Strucklan is President; J. P. Griffin, Secretary, and O. Goodwin, Treasurer. Office at Dallas.

Tidewater Development Company (Electric).—Contracts are soon to be let by this company to build its proposed line from Gadsden, Ala., via Birmingham southwest to Tuscaloosa, 125 miles. (March 15, p. 393.)

Toledo & Defiance.—Incorporated in Ohio with $10,000 capital to build through Lucas, Fulton, Henry and Defiance counties in Ohio. The project is backed by Toledo capitalists.

Walsenburg & Western.—Incorporated in Colorado with $100,000 capital to build from Walsenburg, Colo., northwest via Tolpa and Gardner to Westcliffe, in Custer County, 40 miles, with a branch north to St. Mary in Huerfano County; also another branch through Mosca Pass via the San Luis Valley to Costilla and Saguache counties. E. W. Griffith, F. E. Guy, G. C. Barnard, L. E. Rowland and F. J. Jackson are incorporators.

Wiscasset, Waterville & Farmington.—This company, which operates a narrow gage line from Wiscasset, Me., north to Winslow, 43 miles, has applied for charter renewals of the Maine Light & Power Company, organized to control the development of electrical power along the Sheepscott river from Wiscasset north to Palermo, 30 miles. It also asks for a renewal of the bridge charter to cross the Kennebec river from the present terminal in Winslow to Waterville, which is four miles from the Somerset's southern terminal and junction with the Maine Central.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—This company is said to have bought the branch of the Chicago, Rock Island & Pacific running from North Enid, Okla. T., to Billings, 20 miles. The Atchison is building a connecting line from Tonkawa southwest to Billings.

Bennettsville & Cheraw.—This road, which runs from Bennettsville, S. C., to Kollock, 14 miles, and has been operated by the Chesterfield & Lancaster, has, it is reported, been sold to Pennsylvania capitalists. It is to be extended from Bennettsville to Seller, where it will connect with other lumber lines.

Chesterfield & Lancaster.—See Bennettsville & Cheraw.

Chicago Great Western.—The stockholders have authorized an issue of $3,873,000 additional 4 per cent. debenture stock, making the total outstanding $30,000,000. (Feb. 15, p. 228.)

Chicago, Rock Island & Pacific.—See Atchison, Topeka & Santa Fe.

Chicago Terminal Transfer.—The foreclosure sale has been set for April 25, with $15,140,000 as the upset price. (Mar. 1, p. 290.)

Delaware & Hudson.—This company is arranging for a new entrance into Montreal, Que., through its control of the Quebec, Montreal & Southern. The last named road runs from Noyan Junction, Que., near the New York state line, north to Robert's Junction, which is northeast of Montreal, and near the St. Lawrence river. It also has a line from St. Lambert, opposite Montreal, down the St. Lawrence to Pierreville; its total length is 145 miles. The Napierville Junction is building a line for the Delaware & Hudson from Rouse's Point, N. Y., the present northern terminus of the D. & H., northwest to St. Constant, 27 miles, and negotiations are under way for trackage rights over the Grand Trunk from St. Constant to St. Lambert, and across the river into Montreal, including the use of terminal facilities in that city. Trackage rights are also to be arranged for over the Grand Trunk from Rouse's Point to Noyan Junction. It is expected that during the present year, the Quebec, Montreal & Southern will be extended from Pierreville, 49 miles toward Quebec, and that by the time the Quebec bridge is finished, the road will be further extended, 43 miles to the bridge. When all these plans are carried out, the Delaware & Hudson will have a direct line to Montreal, another to Quebec, and a connecting line along the St. Lawrence river.

This company has acquired $175,000 of the $225,000 capital stock of the Greenwich & Johnsonville, which owns 21 miles of road from Johnsonville, N. Y., via Greenwich to Schuylersville, and is building a branch from Greenwich northeast to a connection with the Rutland & Washington branch of the D. & H. at a point near Salem.

Greenwich & Johnsonville.—See Delaware & Hudson.

Missouri, Kansas & Texas.—Gross earnings for January were $2,293,266, an increase of $600,172; net earnings $741,392, an increase of $360,747.

Napiersville Junction.—See Delaware & Hudson.

New England Railroad.—See New York, New Haven & Hartford.

New York, New Haven & Hartford.—The Massachusetts State Railroad Commission has given this company permission to absorb the New England Railroad, which the New Haven controls and leases. The New England Railroad owns 359 miles of road, including lines from Boston to Hopewell Junction, N. Y,; from Providence, R. I., to Willimantic, Conn., and from East Hartford, Conn., to Springfield, Mass.

Quebec, Montreal & Southern.—See Delaware & Hudson.

Rockland, South Thomaston & Owl's Head (Electric).—The Rockland, South Thomaston & Owl's Head Street Railway was sold by receivers on March 8 to Moses Weil & Sons of Philadelphia for $13,825.

St. Louis & San Francisco.—According to the *Commercial and Financial Chronicle*, this company is to make an issue of equipment notes to pay for 4,500 freight cars recently ordered from the American Car & Foundry Company. The cars are to cost about $5,500,000, and the car-building company will dispose of the notes among the makers of the special equipment for the cars.

Toledo, St. Louis & Western.—An initial semi-annual dividend of 2 per cent. on the $9,952,600 outstanding 4 per cent. non-cumulative preferred stock has been declared payable April 15 to holders of record on March 30.